CR SPECTRA DOCUMENTATION

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Namespace Documentation

3.1 background_diffusion_coefficient Namespace Reference

Functions

- def IonNeutral_Damping (k, medium_props, nu_n=0, theta=0)
- def Duu_Alfven_Slab_Linear_Undamped (mu, E, medium_props, mass=cst.mp, kmin=1e-20, q=1.5, l=1e-4)
- def Kappa_zz (E, medium_props, mass=cst.mp, kmin=(50.∗cst.pc) ∗∗(-1), q=5./3, l=1e-4)
- def J (a, b, c, D, q, x)

Variables

- phase = ism.CNM
- B0 = phase.get('B')
- mi = phase.get("mi")
- mn = phase.get("mn")
- ni = phase.get("ni")
- nn = phase.get("nn")
- T = phase.get("T")
- tuple chi = (mn∗nn)/(mi∗ni)
- VAi = B0/np.sqrt(4∗np.pi∗mi∗ni)
- VA = B0/np.sqrt(4∗np.pi∗(mi∗ni + mn∗nn))
- int nu_in = 2∗nn∗8.4e-9∗(50/1e4)∗∗0.4
- tuple nu_ni = chi∗∗(-1.)∗nu_in
- int k_min = 1e-20
- int k_cm = 1e-15
- int k_cp = 1e-20
- int k_max = 2∗nu_ni/VA
- int E = 10∗cst.GeV
- m = cst.mp
- int gamma = 1 + (E /(m∗cst.c∗∗2))
- v = cst.c∗np.sqrt(1 - (1/(E/(m∗cst.c∗∗2) + 1))∗∗2)
- int p = gamma∗m∗v
- Omega0 = cst.e∗B0/(m∗cst.c)
- int Omega = Omega0/gamma
- mu = np.linspace(-0.99, 0.99, 100)
- d_uu = np.zeros(len(mu))

- int k_zz = 0.
- dmu = mu[1] - mu[0]
- int Itot = 1e-1
- float q = 1.5
- tuple a = (v∗mu[ii] - VA)∗∗2
- int b = 2∗Omega∗(v∗mu[ii] - VA)
- int c = Omega∗∗2 + (- nu_in/2)∗∗2
- int D = b∗∗2 - 4∗a∗c
- eps = VA/v
- int gs0 = 2∗(q-1)∗(B0∗∗2/(8∗np.pi))∗Itot∗k_cp∗∗(q - 1)
- def fj_p = J(a, b, c, D, q, k_max) - J(a, b, c, D, q, k_cp)
- def fj_m = J(a, -b, c, D, q, k_max) - J(a, -b, c, D, q, k_cp)
- int I = -2∗gs0∗(1 - mu[ii]∗eps)∗∗2∗(- nu_in/2.)∗fj_p

3.1.1 Function Documentation

3.1.1.1 Duu_Alfven_Slab_Linear_Undamped()

```
def background_diffusion_coefficient.Duu_Alfven_Slab_Linear_Undamped (
              mu,
              E,
              medium_props,
              mass = cst.mp,
              kmin = 1e-20,
              q = 1.5,
              I = 1e-4 )
```

```
See. Schlickeiser (2002, Chap 13.1.3.1, p.318)

Parameters
----------
mu : TYPE
    DESCRIPTION.
medium_props : TYPE
    DESCRIPTION.
particles_props : TYPE
    DESCRIPTION.
kmin : TYPE, optional
    DESCRIPTION. The default is 1e-20.
q : TYPE, optional
    DESCRIPTION. The default is 1.5.

Returns
-------
D : TYPE
    DESCRIPTION.
```

3.1.1.2 IonNeutral_Damping()

```
def background_diffusion_coefficient.IonNeutral_Damping (
              k,
              medium_props,
              nu_n = 0,
              theta = 0 )
```

3.1.1.3 J()

```
def background_diffusion_coefficient.J (
              a,
              b,
              c,
              D,
              q,
              x )
```

3.1.1.4 Kappa_zz()

```
def background_diffusion_coefficient.Kappa_zz (
              E,
              medium_props,
              mass = cst.mp,
              kmin = (50.*cst.pc)**(-1),
              q = 5./3,
              I = 1e-4 )
```

```
Parameters
----------
E : TYPE
    DESCRIPTION.
medium_props : TYPE
    DESCRIPTION.
mass : TYPE float, optional
    Mass of the diffusin particle. The defaut is m_proton
kmin : TYPE float, optional
    Minimun length in cm^-1 for the turbulence spectra -> Injection length. The default is 50pc**(-1)
q : TYPE float, optional
    Spectral index of the Kolmogorov-like turbulence
    spectrum. The default is 5./3.
I : TYPE float, optional
    Turbulence average level. Defaut is 10^-4

Returns
-------
TYPE
    DESCRIPTION.
```

3.1.2 Variable Documentation

3.1.2.1 a

```
tuple background_diffusion_coefficient.a = (v*mu[ii] - VA)**2
```

3.1.2.2 b

```
int background_diffusion_coefficient.b = 2*Omega*(v*mu[ii] - VA)
```

3.1.2.3 B0

```
background_diffusion_coefficient.B0 = phase.get('B')
```

3.1.2.4 c

```
int background_diffusion_coefficient.c = Omega**2 + (- nu_in/2)**2
```

3.1.2.5 chi

```
tuple background_diffusion_coefficient.chi = (mn*nn)/(mi*ni)
```

3.1.2.6 D

```
int background_diffusion_coefficient.D = b**2 - 4*a*c
```

3.1.2.7 d_uu

```
background_diffusion_coefficient.d_uu = np.zeros(len(mu))
```

3.1.2.8 dmu

```
background_diffusion_coefficient.dmu = mu[1] - mu[0]
```

3.1.2.9 E

```
int background_diffusion_coefficient.E = 10*cst.GeV
```

3.1.2.10 eps

```
background_diffusion_coefficient.eps = VA/v
```

3.1.2.11 fj_m

```
def background_diffusion_coefficient.fj_m = J(a, -b, c, D, q, k_max) - J(a, -b, c, D, q, k_cp)
```

3.1.2.12 fj_p

```
def background_diffusion_coefficient.fj_p = J(a, b, c, D, q, k_max) - J(a, b, c, D, q, k_cp)
```

3.1.2.13 gamma

```
int background_diffusion_coefficient.gamma = 1 + (E /(m*cst.c**2))
```

3.1.2.14 gs0

```
int background_diffusion_coefficient.gs0 = 2*(q-1)*(B0**2/(8*np.pi))*Itot*k_cp**(q - 1)
```

3.1.2.15 I

```
int background_diffusion_coefficient.I = -2*gs0*(1 - mu[ii]*eps)**2*(- nu_in/2.)*fj_p
```

3.1.2.16 Itot

```
int background_diffusion_coefficient.Itot = 1e-1
```

3.1.2.17 k_cm

```
int background_diffusion_coefficient.k_cm = 1e-15
```

3.1.2.18 k_cp

```
int background_diffusion_coefficient.k_cp = 1e-20
```

3.1.2.19 k_max

```
int background_diffusion_coefficient.k_max = 2*nu_ni/VA
```

3.1.2.20 k_min

```
int background_diffusion_coefficient.k_min = 1e-20
```

3.1.2.21 k_zz

```
int background_diffusion_coefficient.k_zz = 0.
```

3.1.2.22 m

```
background_diffusion_coefficient.m = cst.mp
```

3.1.2.23 mi

```
background_diffusion_coefficient.mi = phase.get("mi")
```

3.1.2.24 mn

```
background_diffusion_coefficient.mn = phase.get("mn")
```

3.1.2.25 mu

```
background_diffusion_coefficient.mu = np.linspace(-0.99, 0.99, 100)
```

3.1.2.26 ni

```
background_diffusion_coefficient.ni = phase.get("ni")
```

3.1.2.27 nn

```
background_diffusion_coefficient.nn = phase.get("nn")
```

3.1.2.28 nu_in

```
int background_diffusion_coefficient.nu_in = 2*nn*8.4e-9*(50/1e4)**0.4
```

3.1.2.29 nu_ni

```
tuple background_diffusion_coefficient.nu_ni = chi**(-1.)*nu_in
```

3.1.2.30 Omega

```
int background_diffusion_coefficient.Omega = Omega0/gamma
```

3.1.2.31 Omega0

```
background_diffusion_coefficient.Omega0 = cst.e*B0/(m*cst.c)
```

3.1.2.32 p

```
int background_diffusion_coefficient.p = gamma*m*v
```

3.1.2.33 phase

```
background_diffusion_coefficient.phase = ism.CNM
```

3.1.2.34 q

```
float background_diffusion_coefficient.q = 1.5
```

3.1.2.35 T

```
background_diffusion_coefficient.T = phase.get("T")
```

3.1.2.36 v

```
background_diffusion_coefficient.v = cst.c*np.sqrt(1 - (1/(E/(m*cst.c**2) + 1))**2)
```

3.1.2.37 VA

```
background_diffusion_coefficient.VA = B0/np.sqrt(4*np.pi*(mi*ni + mn*nn))
```

3.1.2.38 VAi

```
background_diffusion_coefficient.VAi = B0/np.sqrt(4*np.pi*mi*ni)
```

3.2 background_diffusion_coefficient_2 Namespace Reference

Functions

- def IonNeutral_Damping (k, medium_props, nu_n=0, theta=0)
- def R (k, medium_props, particles_props, mu, kind="+")
- def g_s (k, kmin, q, medium_props)

Variables

- medium_props = ism.WNM
- float E = 0.001∗cst.GeV
- m = cst.mp
- int gamma = 1 + (E /(m∗cst.c∗∗2))
- v = cst.c∗np.sqrt(1 - (1/(E/(m∗cst.c∗∗2) + 1))∗∗2)
- int p = gamma∗m∗v
- Omega0 = cst.e∗medium_props.get("B")/(m∗cst.c)
- int Omega = Omega0/gamma
- dictionary particles_props = {"v":v, "Omega":Omega}
- mu = np.linspace(-0.99, 0.99, 100)
- k = np.logspace(-20, -10, 100)
- D_uu = np.zeros(len(mu))
- int kmin = 1e-17
- float q = 1.5
- int k_zz = 0.
- float dk = 0.5∗(k[ii+1] - k[ii-1])
- B0 = medium_props.get("B")
- def w = IonNeutral_Damping(k[ii], medium_props)
- def wtot = w.get("wr") + 1j∗w.get("wi")
- float I = dk∗g_s(k[ii], kmin, q, medium_props)∗(1 - (mu[jj]∗wtot)/(k[ii]∗v))∗∗2

3.2.1 Function Documentation

3.2.1.1 g_s()

```
def background_diffusion_coefficient_2.g_s (
              k,
              kmin,
              q,
              medium_props )
```

3.2.1.2 IonNeutral_Damping()

```
def background_diffusion_coefficient_2.IonNeutral_Damping (
              k,
              medium_props,
              nu_n = 0,
              theta = 0 )
```

3.2.1.3 R()

```
def background_diffusion_coefficient_2.R (
              k,
              medium_props,
              particles_props,
              mu,
              kind = "+" )
```

3.2.2 Variable Documentation

3.2.2.1 B0

```
background_diffusion_coefficient_2.B0 = medium_props.get("B")
```

3.2.2.2 D_uu

```
background_diffusion_coefficient_2.D_uu = np.zeros(len(mu))
```

3.2.2.3 dk

```
float background_diffusion_coefficient_2.dk = 0.5*(k[ii+1] - k[ii-1])
```

3.2.2.4 E

```
float background_diffusion_coefficient_2.E = 0.001*cst.GeV
```

3.2.2.5 gamma

```
int background_diffusion_coefficient_2.gamma = 1 + (E /(m*cst.c**2))
```

3.2.2.6 I

```
float background_diffusion_coefficient_2.I = dk*g_s(k[ii], kmin, q, medium_props)*(1 - (mu[jj]*wtot)/(k[ii]*v)
```

3.2.2.7 k

```
background_diffusion_coefficient_2.k = np.logspace(-20, -10, 100)
```

3.2.2.8 k_zz

```
int background_diffusion_coefficient_2.k_zz = 0.
```

3.2.2.9 kmin

```
int background_diffusion_coefficient_2.kmin = 1e-17
```

3.2.2.10 m

```
background_diffusion_coefficient_2.m = cst.mp
```

3.2.2.11 medium_props

```
background_diffusion_coefficient_2.medium_props = ism.WNM
```

3.2.2.12 mu

```
background_diffusion_coefficient_2.mu = np.linspace(-0.99, 0.99, 100)
```

3.2.2.13 Omega

```
dictionary background_diffusion_coefficient_2.Omega = Omega0/gamma
```

3.2.2.14 Omega0

```
background_diffusion_coefficient_2.Omega0 = cst.e*medium_props.get("B")/(m*cst.c)
```

3.2.2.15 p

```
int background_diffusion_coefficient_2.p = gamma*m*v
```

3.2.2.16 particles_props

```
dictionary background_diffusion_coefficient_2.particles_props = {"v":v, "Omega":Omega}
```

3.2.2.17 q

```
float background_diffusion_coefficient_2.q = 1.5
```

3.2.2.18 v

```
background_diffusion_coefficient_2.v = cst.c*np.sqrt(1 - (1/(E/(m*cst.c**2) + 1))**2)
```

3.2.2.19 w

```
def background_diffusion_coefficient_2.w = IonNeutral_Damping(k[ii], medium_props)
```

3.2.2.20 wtot

```
def background_diffusion_coefficient_2.wtot = w.get("wr") + 1j*w.get("wi")
```

3.3 background_diffusion_coefficient_3 Namespace Reference

Functions

- def IonNeutral_Damping (k, medium_props, nu_n=0, theta=0)
- def Duu_Alfven_Slab_Linear_Undamped (mu, E, medium_props, mass=cst.mp, kmin=1e-20, q=1.5, l=1e-4)
- def Kappa_zz (E, medium_props, mass=cst.mp, kmin=1e-20, q=5./3, l=1e28)
- def kappa_zz_BC (E, d00, delta)

Variables

- float Emin = 0.1∗cst.GeV
- int Emax = 100∗cst.TeV
- E = np.logspace(np.log10(Emin), np.log10(Emax), 100)
- K_zz_bc_1 = np.zeros(len(E))
- K_zz_bc_2 = np.zeros(len(E))
- K_zz_1 = np.zeros(len(E))
- K_zz_2 = np.zeros(len(E))
- K_zz_HII_1 = np.zeros(len(E))
- K_zz_WIM_1 = np.zeros(len(E))
- K_zz_WNM_1 = np.zeros(len(E))
- K_zz_CNM_1 = np.zeros(len(E))
- K_zz_DiM_1 = np.zeros(len(E))
- K_zz_DeM_1 = np.zeros(len(E))
- K_zz_DeC_1 = np.zeros(len(E))
- K_zz_HII_2 = np.zeros(len(E))
- K_zz_WIM_2 = np.zeros(len(E))
- K_zz_WNM_2 = np.zeros(len(E))
- K_zz_CNM_2 = np.zeros(len(E))
- K_zz_DiM_2 = np.zeros(len(E))
- K_zz_DeM_2 = np.zeros(len(E))
- K_zz_DeC_2 = np.zeros(len(E))
- HII
- mass
- mp
- kmin
- q
- l
- WIM
- WNM
- CNM
- DiM
- DeM
- DeC
- int size_x = 4
- int size_y = 3
- int sub_x = 2
- int sub_y = 2
- fig = plt.figure(figsize=(size_x∗sub_x,size_y∗sub_y))
- gs = gridspec.GridSpec(ncols= sub_x, nrows = sub_y, figure = fig)
- wspace
- hspace
- ax0 = fig.add_subplot(gs[0, 0])
- GeV
- c
- ls
- facecolor
- alpha
- hatch
- label
- loc
- ax1 = fig.add_subplot(gs[0, 1])
- ax2 = fig.add_subplot(gs[1, 0])
- ax3 = fig.add_subplot(gs[1, 1])

- list custom_lines
- handles
- bbox_to_anchor
- ncol
- int ymin = 1e27
- int ymax = 1e33
- int xmin = 1e-1
- int xmax = 1e5

3.3.1 Function Documentation

3.3.1.1 Duu_Alfven_Slab_Linear_Undamped()

```
def background_diffusion_coefficient_3.Duu_Alfven_Slab_Linear_Undamped (
              mu,
              E,
              medium_props,
              mass = cst.mp,
              kmin = 1e-20,
              q = 1.5,
              I = 1e-4 )
```

```
See. Schlickeiser (2002, Chap 13.1.3.1, p.318)

Parameters
----------
mu : TYPE
    DESCRIPTION.
medium_props : TYPE
    DESCRIPTION.
particles_props : TYPE
    DESCRIPTION.
kmin : TYPE, optional
    DESCRIPTION. The default is 1e-20.
q : TYPE, optional
    DESCRIPTION. The default is 1.5.

Returns
-------
D : TYPE
    DESCRIPTION.
```

3.3.1.2 IonNeutral_Damping()

```
def background_diffusion_coefficient_3.IonNeutral_Damping (
              k,
              medium_props,
              nu_n = 0,
              theta = 0 )
```

3.3.1.3 Kappa_zz()

```
def background_diffusion_coefficient_3.Kappa_zz (
              E,
              medium_props,
              mass = cst.mp,
              kmin = 1e-20,
              q = 5./3,
              I = 1e28 )
```

```
Parameters
----------
E : TYPE
    DESCRIPTION.
medium_props : TYPE
    DESCRIPTION.
mass : TYPE float, optional
    Mass of the diffusin particle. The defaut is m_proton
kmin : TYPE float, optional
    Minimun length in cm^-1 for the turbulence spectra. The default is 1e-20.
q : TYPE float, optional
    Spectral index of the Kolmogorov-like turbulence
    spectrum. The default is 5./3.
I : TYPE float, optional
    Diffusion coefficient normalization value for 1GeV particle and 5./3 spectrum. The default is 1e28.

Returns
-------
TYPE
    DESCRIPTION.
```

3.3.1.4 kappa_zz_BC()

```
def background_diffusion_coefficient_3.kappa_zz_BC (
              E,
              d00,
              delta )
```

3.3.2 Variable Documentation

3.3.2.1 alpha

```
background_diffusion_coefficient_3.alpha
```

3.3.2.2 ax0

```
background_diffusion_coefficient_3.ax0 = fig.add_subplot(gs[0, 0])
```

3.3.2.3 ax1

```
background_diffusion_coefficient_3.ax1 = fig.add_subplot(gs[0, 1])
```

3.3.2.4 ax2

```
background_diffusion_coefficient_3.ax2 = fig.add_subplot(gs[1, 0])
```

3.3.2.5 ax3

```
background_diffusion_coefficient_3.ax3 = fig.add_subplot(gs[1, 1])
```

3.3.2.6 bbox_to_anchor

```
background_diffusion_coefficient_3.bbox_to_anchor
```

3.3.2.7 c

```
background_diffusion_coefficient_3.c
```

3.3.2.8 CNM

```
background_diffusion_coefficient_3.CNM
```

3.3.2.9 custom_lines

```
background_diffusion_coefficient_3.custom_lines
```

Initial value:

```
1 =  [Line2D([0],[0], color = "white", label = "ISM independant"),
2                Line2D([0],[0], color = "white", label = "ISM dependant"),
3                Line2D([0],[0], color = "black", ls = '--', label = "$\\delta = 0.5$, $d_{00} = 10^{28}$
       cm$^{2}$s$^{-1}$"),
4                Line2D([0],[0], color = "black", ls = '--', label = "$q = 3/2$, $I_\\pm = 10^{-4}$"),
5                Line2D([0],[0], color = "black", ls = '-', label = "$\\delta = 2/3$, $d_{00} = 10^{29}$
       cm$^{2}$s$^{-1}$"),
6                Line2D([0],[0], color = "black", ls = '-', label = "$q = 5/3$, $I_\\pm = 10^{-4}$")
7                ]
```

3.3.2.10 DeC

background_diffusion_coefficient_3.DeC

3.3.2.11 DeM

background_diffusion_coefficient_3.DeM

3.3.2.12 DiM

background_diffusion_coefficient_3.DiM

3.3.2.13 E

```
background_diffusion_coefficient_3.E = np.logspace(np.log10(Emin), np.log10(Emax), 100)
```

3.3.2.14 Emax

```
int background_diffusion_coefficient_3.Emax = 100*cst.TeV
```

3.3.2.15 Emin

```
float background_diffusion_coefficient_3.Emin = 0.1*cst.GeV
```

3.3.2.16 facecolor

background_diffusion_coefficient_3.facecolor

3.3.2.17 fig

```
background_diffusion_coefficient_3.fig = plt.figure(figsize=(size_x*sub_x,size_y*sub_y))
```

3.3.2.18 GeV

```
background_diffusion_coefficient_3.GeV
```

3.3.2.19 gs

```
background_diffusion_coefficient_3.gs = gridspec.GridSpec(ncols= sub_x, nrows = sub_y, figure
= fig )
```

3.3.2.20 handles

```
background_diffusion_coefficient_3.handles
```

3.3.2.21 hatch

```
background_diffusion_coefficient_3.hatch
```

3.3.2.22 HII

```
background_diffusion_coefficient_3.HII
```

3.3.2.23 hspace

```
background_diffusion_coefficient_3.hspace
```

3.3.2.24 I

```
background_diffusion_coefficient_3.I
```

3.3.2.25 K_zz_1

```
background_diffusion_coefficient_3.K_zz_1 = np.zeros(len(E))
```

3.3.2.26 K_zz_2

```
background_diffusion_coefficient_3.K_zz_2 = np.zeros(len(E))
```

3.3.2.27 K_zz_bc_1

```
background_diffusion_coefficient_3.K_zz_bc_1 = np.zeros(len(E))
```

3.3.2.28 K_zz_bc_2

```
background_diffusion_coefficient_3.K_zz_bc_2 = np.zeros(len(E))
```

3.3.2.29 K_zz_CNM_1

```
background_diffusion_coefficient_3.K_zz_CNM_1 = np.zeros(len(E))
```

3.3.2.30 K_zz_CNM_2

```
background_diffusion_coefficient_3.K_zz_CNM_2 = np.zeros(len(E))
```

3.3.2.31 K_zz_DeC_1

```
background_diffusion_coefficient_3.K_zz_DeC_1 = np.zeros(len(E))
```

3.3.2.32 K_zz_DeC_2

```
background_diffusion_coefficient_3.K_zz_DeC_2 = np.zeros(len(E))
```

3.3.2.33 K_zz_DeM_1

```
background_diffusion_coefficient_3.K_zz_DeM_1 = np.zeros(len(E))
```

3.3.2.34 K_zz_DeM_2

```
background_diffusion_coefficient_3.K_zz_DeM_2 = np.zeros(len(E))
```

3.3.2.35 K_zz_DiM_1

```
background_diffusion_coefficient_3.K_zz_DiM_1 = np.zeros(len(E))
```

3.3.2.36 K_zz_DiM_2

```
background_diffusion_coefficient_3.K_zz_DiM_2 = np.zeros(len(E))
```

3.3.2.37 K_zz_HII_1

```
background_diffusion_coefficient_3.K_zz_HII_1 = np.zeros(len(E))
```

3.3.2.38 K_zz_HII_2

```
background_diffusion_coefficient_3.K_zz_HII_2 = np.zeros(len(E))
```

3.3.2.39 K_zz_WIM_1

```
background_diffusion_coefficient_3.K_zz_WIM_1 = np.zeros(len(E))
```

3.3.2.40 K_zz_WIM_2

```
background_diffusion_coefficient_3.K_zz_WIM_2 = np.zeros(len(E))
```

3.3.2.41 K_zz_WNM_1

```
background_diffusion_coefficient_3.K_zz_WNM_1 = np.zeros(len(E))
```

3.3.2.42 K_zz_WNM_2

```
background_diffusion_coefficient_3.K_zz_WNM_2 = np.zeros(len(E))
```

3.3.2.43 kmin

```
background_diffusion_coefficient_3.kmin
```

3.3.2.44 label

```
background_diffusion_coefficient_3.label
```

3.3.2.45 loc

```
background_diffusion_coefficient_3.loc
```

3.3.2.46 ls

```
background_diffusion_coefficient_3.ls
```

3.3.2.47 mass

```
background_diffusion_coefficient_3.mass
```

3.3.2.48 mp

```
background_diffusion_coefficient_3.mp
```

3.3.2.49 ncol

```
background_diffusion_coefficient_3.ncol
```

3.3.2.50 q

```
background_diffusion_coefficient_3.q
```

3.3.2.51 size_x

```
int background_diffusion_coefficient_3.size_x = 4
```

3.3.2.52 size_y

```
int background_diffusion_coefficient_3.size_y = 3
```

3.3.2.53 sub_x

```
int background_diffusion_coefficient_3.sub_x = 2
```

3.3.2.54 sub_y

```
int background_diffusion_coefficient_3.sub_y = 2
```

3.3.2.55 WIM

```
background_diffusion_coefficient_3.WIM
```

3.3.2.56 WNM

```
background_diffusion_coefficient_3.WNM
```

3.3.2.57 wspace

```
background_diffusion_coefficient_3.wspace
```

3.3.2.58 xmax

```
int background_diffusion_coefficient_3.xmax = 1e5
```

3.3.2.59 xmin

```
int background_diffusion_coefficient_3.xmin = 1e-1
```

3.3.2.60 ymax

```
int background_diffusion_coefficient_3.ymax = 1e33
```

3.3.2.61 ymin

```
int background_diffusion_coefficient_3.ymin = 1e27
```

3.4 constants Namespace Reference

Variables

- float yr = 3.154e+7
- int kyr = 1e3∗yr
- float pc = 3.086e18
- int kpc = 1.e3∗pc
- float GeV = 0.00160218
- int TeV = 1e3∗GeV
- float eV = GeV∗1e-9
- int MeV = 1e-3∗GeV
- float me = 9.10938e-28
- float mp = 1.6726219e-24
- float mn = 1.6749286e-24
- float mHI = mp
- float mHII = mp
- int mHeI = 2∗mp + 2∗mn
- int mHeII = 2∗mp + 2∗mn
- int mCII = 6∗mp + 6∗mn
- int mHCOII = 8∗mp + 8∗mn + 6∗mp + 6∗mn + mp + mn
- int mH2 = 2∗mp
- float e = 4.80326e-10
- int c = 29979245800.
- float kbolz = 1.3807e-16
- int kms = 1e5

3.4.1 Variable Documentation

3.4.1.1 c

```
int constants.c = 29979245800.
```

3.4.1.2 e

```
float constants.e = 4.80326e-10
```

3.4.1.3 eV

```
float constants.eV = GeV*1e-9
```

3.4.1.4 GeV

```
float constants.GeV = 0.00160218
```

3.4.1.5 kbolz

```
float constants.kbolz = 1.3807e-16
```

3.4.1.6 kms

```
int constants.kms = 1e5
```

3.4.1.7 kpc

```
int constants.kpc = 1.e3*pc
```

3.4.1.8 kyr

```
int constants.kyr = 1e3*yr
```

3.4.1.9 mCII

```
int constants.mCII = 6*mp + 6*mn
```

3.4.1.10 me

```
float constants.me = 9.10938e-28
```

3.4.1.11 MeV

```
int constants.MeV = 1e-3*GeV
```

3.4.1.12 mH2

```
int constants.mH2 = 2*mp
```

3.4.1.13 mHCOII

```
int constants.mHCOII = 8*mp + 8*mn + 6*mp + 6*mn + mp + mn
```

3.4.1.14 mHeI

```
int constants.mHeI = 2*mp + 2*mn
```

3.4.1.15 mHeII

```
int constants.mHeII = 2*mp + 2*mn
```

3.4.1.16 mHI

```
float constants.mHI = mp
```

3.4.1.17 mHII

```
float constants.mHII = mp
```

3.4.1.18 mn

```
float constants.mn = 1.6749286e-24
```

3.4.1.19 mp

```
float constants.mp = 1.6726219e-24
```

3.4.1.20 pc

```
float constants.pc = 3.086e18
```

3.4.1.21 TeV

```
int constants.TeV = 1e3*GeV
```

3.4.1.22 yr

```
float constants.yr = 3.154e+7
```

3.5 d1_grid_generator Namespace Reference

Functions

- def grid (Smin, Smax, Ns, name, s_center=None, width=None, smooth=None, dXmin=0.01 *cst.pc)

3.5.1 Function Documentation

3.5.1.1 grid()

```
def d1_grid_generator.grid (
              Smin,
              Smax,
              Ns,
              name,
              s_center = None,
              width = None,
              smooth = None,
              dXmin = 0.01*cst.pc )
```

3.6 damping Namespace Reference

Functions

- def IN_damping_approx_2 (E, medium_props, theta=0)
- def IN_damping_approx_1 (E, medium_props, nu_n=0, theta=0)
- def IonNeutral_Damping (E, medium_props, nu_n=0, theta=0)
- def indamping_alfven (position_index, E, medium_props)
- def indamping_alfven_nopos (E, medium_props)
- def damping_lazarian (position_index, E, medium_props)
- def damping_lazarian_nopos (E, medium_props)
- def non_linear_landau_damping (T, lp, lm, mi, q, B0, Ecr)

3.6.1 Function Documentation

3.6.1.1 damping_lazarian()

```
def damping.damping_lazarian (
              position_index,
              E,
              medium_props )
```

3.6.1.2 damping_lazarian_nopos()

```
def damping.damping_lazarian_nopos (
              E,
              medium_props )
```

3.6.1.3 IN_damping_approx_1()

```
def damping.IN_damping_approx_1 (
              E,
              medium_props,
              nu_n = 0,
              theta = 0 )
```

```
From Xu et al. (2016), M2 internship p. 20

Parameters
----------
E : TYPE
    DESCRIPTION.
medium_props : TYPE
    DESCRIPTION.
nu_n : TYPE, optional
    DESCRIPTION. The default is 0.
theta : TYPE, optional
    DESCRIPTION. The default is 0.

Returns
-------
None.
```

3.6.1.4 IN_damping_approx_2()

```
def damping.IN_damping_approx_2 (
              E,
              medium_props,
              theta = 0 )
```

```
From Xu et al. (2016), M2 internship p. 20, asymptotic regime

Parameters
----------
E : TYPE
    DESCRIPTION.
medium_props : TYPE
    DESCRIPTION.
theta : TYPE, optional
    DESCRIPTION. The default is 0.

Returns
-------
None.
```

3.6.1.5 indamping_alfven()

```
def damping.indamping_alfven (
              position_index,
              E,
              medium_props )
```

3.6.1.6 indamping_alfven_nopos()

```
def damping.indamping_alfven_nopos (
              E,
              medium_props )
```

3.6.1.7 IonNeutral_Damping()

```
def damping.IonNeutral_Damping (
              E,
              medium_props,
              nu_n = 0,
              theta = 0 )
```

3.6.1.8 non_linear_landau_damping()

```
def damping.non_linear_landau_damping (
              T,
              Ip,
              Im,
              mi,
              q,
              B0,
              Ecr )
```

3.7 damping_models Namespace Reference

Functions

- def damprate_to_damptime (gamma)

Variables

- int NE = 10
- float Emin = 0.99∗cst.GeV
- float Emax = 100.01∗cst.TeV
- string egridtype = "logspace"
- E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)
- list phases = [ism.HII, ism.WIM, ism.WNM, ism.CNM, ism.DiM, ism.DeM, ism.DeC]
- list xlim = [Emin/cst.GeV, Emax/cst.GeV]
- list xlims = [xlim, xlim, xlim, xlim, xlim, xlim, xlim]
- list ylim = [1e-14, 1e-3]
- list ylims = [ylim, ylim, ylim, ylim, ylim, ylim, ylim]
- list Name = ["HII", "WIM", "WNM", "CNM", "DiM", "DeM", "DeC"]
- int size_x = 4

- int size_y = 3
- int sub_x = 2
- int sub_y = 4
- fig = plt.figure(figsize=(size_x∗sub_x,size_y∗sub_y))
- gs = gridspec.GridSpec(ncols= sub_x, nrows = sub_y, figure = fig)
- wspace
- hspace
- list pos_1 = [0, 0, 1, 1, 2, 2, 3, 3]
- list pos_2 = [0, 1, 0, 1, 0, 1, 0, 1]
- wR_Alfven = np.zeros(len(E))
- wI_Alfven = np.zeros(len(E))
- wR_Alfven_o1 = np.zeros(len(E))
- wI_Alfven_o1 = np.zeros(len(E))
- wR_Alfven_o2 = np.zeros(len(E))
- wI_Alfven_o2 = np.zeros(len(E))
- Ep = np.NaN
- Em = np.NaN
- Gamma_lz = np.zeros(len(E))
- Gamma_nlld_inf = np.zeros(len(E))
- Gamma_nlld_sup = np.zeros(len(E))
- in_damping = dp.IonNeutral_Damping(E[e], phases[pi], nu_n = 0, theta = 0)
- lz_damping = dp.damping_lazarian_nopos(E[e], phases[pi])
- lz_min = lz_damping[1]
- int linf = 1e-4
- int lsup = 1e-1
- ax = fig.add_subplot(gs[pos_1[pi], pos_2[pi]])
- GeV
- c
- ls
- lw
- alpha
- color
- facecolor
- x
- y
- label
- loc
- bbox_to_anchor
- bbox_inches
- pad_inches

3.7.1 Function Documentation

3.7.1.1 damprate_to_damptime()

```
def damping_models.damprate_to_damptime (
              gamma )
```

3.7.2 Variable Documentation

3.7.2.1 alpha

damping_models.alpha

3.7.2.2 ax

damping_models.ax = fig.add_subplot(gs[pos_1[pi], pos_2[pi]])

3.7.2.3 bbox_inches

damping_models.bbox_inches

3.7.2.4 bbox_to_anchor

damping_models.bbox_to_anchor

3.7.2.5 c

damping_models.c

3.7.2.6 color

damping_models.color

3.7.2.7 E

damping_models.E = grid.grid(Emin, Emax, 2**NE, egridtype)

3.7.2.8 egridtype

```
string damping_models.egridtype = "logspace"
```

3.7.2.9 Em

```
damping_models.Em = np.NaN
```

3.7.2.10 Emax

```
float damping_models.Emax = 100.01*cst.TeV
```

3.7.2.11 Emin

```
float damping_models.Emin = 0.99*cst.GeV
```

3.7.2.12 Ep

```
damping_models.Ep = np.NaN
```

3.7.2.13 facecolor

```
damping_models.facecolor
```

3.7.2.14 fig

```
damping_models.fig = plt.figure(figsize=(size_x*sub_x,size_y*sub_y))
```

3.7.2.15 Gamma_lz

```
damping_models.Gamma_lz = np.zeros(len(E))
```

3.7.2.16 Gamma_nlld_inf

```
damping_models.Gamma_nlld_inf = np.zeros(len(E))
```

3.7.2.17 Gamma_nlld_sup

```
damping_models.Gamma_nlld_sup = np.zeros(len(E))
```

3.7.2.18 GeV

```
damping_models.GeV
```

3.7.2.19 gs

```
damping_models.gs = gridspec.GridSpec(ncols= sub_x, nrows = sub_y, figure = fig )
```

3.7.2.20 hspace

```
damping_models.hspace
```

3.7.2.21 Iinf

```
int damping_models.Iinf = 1e-4
```

3.7.2.22 in_damping

```
damping_models.in_damping = dp.IonNeutral_Damping(E[e], phases[pi], nu_n = 0, theta = 0)
```

3.7.2.23 Isup

```
int damping_models.Isup = 1e-1
```

3.7.2.24 label

```
damping_models.label
```

3.7.2.25 loc

```
damping_models.loc
```

3.7.2.26 ls

```
damping_models.ls
```

3.7.2.27 lw

```
damping_models.lw
```

3.7.2.28 lz_damping

```
damping_models.lz_damping = dp.damping_lazarian_nopos(E[e], phases[pi])
```

3.7.2.29 lz_min

```
damping_models.lz_min = lz_damping[1]
```

3.7.2.30 Name

```
list damping_models.Name = ["HII", "WIM", "WNM", "CNM", "DiM", "DeM", "DeC"]
```

3.7.2.31 NE

```
int damping_models.NE = 10
```

3.7.2.32 pad_inches

```
damping_models.pad_inches
```

3.7.2.33 phases

```
list damping_models.phases = [ism.HII, ism.WIM, ism.WNM, ism.CNM, ism.DiM, ism.DeM, ism.DeC]
```

3.7.2.34 pos_1

```
list damping_models.pos_1 = [0, 0, 1, 1, 2, 2, 3, 3]
```

3.7.2.35 pos_2

```
list damping_models.pos_2 = [0, 1, 0, 1, 0, 1, 0, 1]
```

3.7.2.36 size_x

```
int damping_models.size_x = 4
```

3.7.2.37 size_y

```
int damping_models.size_y = 3
```

3.7.2.38 sub_x

```
int damping_models.sub_x = 2
```

3.7.2.39 sub_y

```
int damping_models.sub_y = 4
```

3.7.2.40 wI_Alfven

```
damping_models.wI_Alfven = np.zeros(len(E))
```

3.7.2.41 wI_Alfven_o1

```
damping_models.wI_Alfven_o1 = np.zeros(len(E))
```

3.7.2.42 wI_Alfven_o2

```
damping_models.wI_Alfven_o2 = np.zeros(len(E))
```

3.7.2.43 wR_Alfven

```
damping_models.wR_Alfven = np.zeros(len(E))
```

3.7.2.44 wR_Alfven_o1

```
damping_models.wR_Alfven_o1 = np.zeros(len(E))
```

3.7.2.45 wR_Alfven_o2

```
damping_models.wR_Alfven_o2 = np.zeros(len(E))
```

3.7.2.46 wspace

```
damping_models.wspace
```

3.7.2.47 x

```
damping_models.x
```

3.7.2.48 xlim

```
list damping_models.xlim = [Emin/cst.GeV, Emax/cst.GeV]
```

3.7.2.49 xlims

```
list damping_models.xlims = [xlim, xlim, xlim, xlim, xlim, xlim, xlim]
```

3.7.2.50 y

```
damping_models.y
```

3.7.2.51 ylim

```
list damping_models.ylim = [1e-14, 1e-3]
```

3.7.2.52 ylims

```
list damping_models.ylims = [ylim, ylim, ylim, ylim, ylim, ylim, ylim]
```

3.8 Data_reader Namespace Reference

Functions

- def readDataXE (file_name, NX, NE)
- def readAxis (file_name)

Variables

- def data = readDataXE("../data_out/Pcr_0165.dat", 2**11, 2**5)
- def X = readAxis("../data_ini/X.dat")
- def E = readAxis("../data_ini/E.dat")
- figsize

3.8.1 Function Documentation

3.8.1.1 readAxis()

```
def Data_reader.readAxis (
              file_name )
```

3.8.1.2 readDataXE()

```
def Data_reader.readDataXE (
              file_name,
              NX,
              NE )
```

3.8.2 Variable Documentation

3.8.2.1 data

```
def Data_reader.data = readDataXE("../data_out/Pcr_0165.dat", 2**11, 2**5)
```

3.8.2.2 E

```
def Data_reader.E = readAxis("../data_ini/E.dat")
```

3.8.2.3 figsize

```
Data_reader.figsize
```

3.8.2.4 X

```
def Data_reader.X = readAxis("../data_ini/X.dat")
```

3.9 electrons_emax_t Namespace Reference

Functions

- def InverseTrigonalMatrix (T)

  FUNCTIONS IN ORDER TO CREATE A GOOD SPLINE !!! #.
- def ProductMatrix (A, B)
- def InterpolatingSpline (X, Y)
- def Rsh (nt)
- def B (t, ts, tB, alpha_B, BISM, Bfree)

  ELECTRON ESCAPE MODEL (from Ohira et al.
- def eta_g (t, ts, tB, alpha, alpha_B, eta_free)
- def Em_age (t, ts, tB, alpha_B, alpha, BISM, Bfree, eta_acc, eta_free, Rs)
- def Em_cool (t, ts, tB, alpha_B, alpha, BISM, Bfree, Ems)
- def Em_esc (t, ts, tB, alpha_B, alpha, BISM, Bfree, eta_acc, eta_free, eta_esc, Rs)
- def Emax_electrons (time)
- def escape_time (E, tSed, EM, delta)

Variables

- float alpha = 2.6
- int alpha_B = 9./10
- int xhi_m = 1
- float xhi_cr = 0.1
- int E51 = 1
- int Mej = 1
- int C06 = 1
- int beta = 1
- int phi_c = 1
- int vej8 = 10.∗(E51/Mej)∗∗(0.5)
- float nt = 0.35
- float tsed = 0.3∗E51∗∗(-0.5)∗Mej∗nt∗∗(-1./3)∗cst.kyr

  FUNCTIONS IN ORDER TO MAKE OUR SNR EXPAND IN THE ISM #.
- def EM = Emax_electrons(tsed)
- E = np.logspace(np.log10(1∗cst.GeV), np.log10(100∗cst.TeV), num=100)
- tesc = np.zeros(len(E))

3.9.1 Function Documentation

3.9.1.1 B()

```
def electrons_emax_t.B (
                t,
                ts,
                tB,
                alpha_B,
                BISM,
                Bfree )
```

ELECTRON ESCAPE MODEL (from Ohira et al.

(2012)) #

3.9.1.2 Em_age()

```
def electrons_emax_t.Em_age (
              t,
              ts,
              tB,
              alpha_B,
              alpha,
              BISM,
              Bfree,
              eta_acc,
              eta_free,
              Rs )
```

3.9.1.3 Em_cool()

```
def electrons_emax_t.Em_cool (
              t,
              ts,
              tB,
              alpha_B,
              alpha,
              BISM,
              Bfree,
              Ems )
```

3.9.1.4 Em_esc()

```
def electrons_emax_t.Em_esc (
              t,
              ts,
              tB,
              alpha_B,
              alpha,
              BISM,
              Bfree,
              eta_acc,
              eta_free,
              eta_esc,
              Rs )
```

3.9.1.5 Emax_electrons()

```
def electrons_emax_t.Emax_electrons (
              time )
```

3.9.1.6 escape_time()

```
def electrons_emax_t.escape_time (
              E,
              tSed,
              EM,
              delta )
```

3.9.1.7 eta_g()

```
def electrons_emax_t.eta_g (
              t,
              ts,
              tB,
              alpha,
              alpha_B,
              eta_free )
```

3.9.1.8 InterpolatingSpline()

```
def electrons_emax_t.InterpolatingSpline (
              X,
              Y )
```

3.9.1.9 InverseTrigonalMatrix()

```
def electrons_emax_t.InverseTrigonalMatrix (
              T )
```

FUNCTIONS IN ORDER TO CREATE A GOOD SPLINE !!! #.

TriDiagonal matrix inversion function

3.9.1.10 ProductMatrix()

```
def electrons_emax_t.ProductMatrix (
              A,
              B )
```

3.9.1.11 Rsh()

```
def electrons_emax_t.Rsh (
              nt )
```

3.9.2 Variable Documentation

3.9.2.1 alpha

```
float electrons_emax_t.alpha = 2.6
```

3.9.2.2 alpha_B

```
int electrons_emax_t.alpha_B = 9./10
```

3.9.2.3 beta

```
int electrons_emax_t.beta = 1
```

3.9.2.4 C06

```
int electrons_emax_t.C06 = 1
```

3.9.2.5 E

```
electrons_emax_t.E = np.logspace(np.log10(1*cst.GeV), np.log10(100*cst.TeV), num=100)
```

3.9.2.6 E51

```
int electrons_emax_t.E51 = 1
```

3.9.2.7 EM

```
def electrons_emax_t.EM = Emax_electrons(tsed)
```

3.9.2.8 Mej

```
int electrons_emax_t.Mej = 1
```

3.9.2.9 nt

```
float electrons_emax_t.nt = 0.35
```

3.9.2.10 phi_c

```
int electrons_emax_t.phi_c = 1
```

3.9.2.11 tesc

```
electrons_emax_t.tesc = np.zeros(len(E))
```

3.9.2.12 tsed

```
float electrons_emax_t.tsed = 0.3*E51**(-0.5)*Mej*nt**(-1./3)*cst.kyr
```

FUNCTIONS IN ORDER TO MAKE OUR SNR EXPAND IN THE ISM #.

We define the characteristic times of our problem

3.9.2.13 vej8

```
int electrons_emax_t.vej8 = 10.*(E51/Mej)**(0.5)
```

3.9.2.14 xhi_cr

```
float electrons_emax_t.xhi_cr = 0.1
```

3.9.2.15 xhi_m

```
int electrons_emax_t.xhi_m = 1
```

3.10 EscapeModel_protons Namespace Reference

Functions

- def InverseTrigonalMatrix (T)

  FUNCTIONS IN ORDER TO CREATE A GOOD SPLINE !!! #.
- def ProductMatrix (A, B)
- def InterpolatingSpline (X, Y)
- def f1 (x, const)
- def df1dx (x, const)
- def f2 (x, const)
- def df2dx (x, const)
- def NewtonRaphson (f, df, x0, eps, const)
- def Gettesc (E, delta)

Variables

- float nt = 0.35
- int xhi_m = 1
- float xhi_cr = 0.1
- int E51 = 1
- int Mej = 1
- int C06 = 1
- int beta = 1
- int phi_c = 1
- int vej8 = 10.∗(E51/Mej)∗∗(0.5)
- int tini = 1e-4∗cst.kyr

  FUNCTIONS IN ORDER TO MAKE OUR SNR EXPAND IN THE ISM #.
- float tfree = 0.3∗E51∗∗(-0.5)∗Mej∗nt∗∗(-1./3)∗cst.kyr
- float tPDS = np.exp(-1.)∗3.61e4∗E51∗∗(3./14)/(xhi_m∗∗(5./14)∗nt∗∗(4./7))∗cst.yr
- float tMCS = min(61∗vej8∗∗3/(xhi_m∗∗(9./14)∗nt∗∗(3./7)∗E51∗∗(3./14)), 476./(xhi_m∗phi_c)∗∗(9./14))∗tPDS
- int tmerge = 153.∗(E51∗∗(1./14)∗nt∗∗(1./7)∗xhi_m∗∗(3./14)/(beta∗C06))∗∗(10./7)∗tPDS
- tmax = min(tMCS, tmerge)
- float R_free = 5.0∗(E51/nt)∗∗(1./5)∗(1 - (0.05∗Mej∗∗(5./6))/(E51∗∗0.5∗nt∗∗(1./3)∗(tfree/cst.kyr)))∗∗(2./5)∗(tfree/cst.↩kyr)∗∗(2./5)∗cst.pc
- float R_ini = R_free∗(tini/tfree)∗∗(1.)
- float R_PDS = 5.0∗(E51/nt)∗∗(1./5)∗(1 - (0.05∗Mej∗∗(5./6))/(E51∗∗0.5∗nt∗∗(1./3)∗(tPDS/cst.kyr)))∗∗(2./5)∗(t↩PDS/cst.kyr)∗∗(2./5)∗cst.pc
- float R_MCS = R_PDS∗(tMCS/tPDS)∗∗(3./10)
- float R_merge = R_MCS∗(tmerge/tMCS)∗∗(1./4)
- t = np.array([tini, tfree, tPDS, tMCS, tmerge])
- R = np.array([R_ini, R_free, R_PDS, R_MCS, R_merge])
- logt = np.empty(len(t))
- logR = np.empty(len(R))
- def f_SNR = InterpolatingSpline(logt, logR)
- logt_new = np.linspace(logt[0], logt[-1], 100)
- logr_new = np.empty(len(logt_new))

- t_new = np.empty(len(logt_new))
- r_new = np.empty(len(logr_new))
- u_sh = np.empty(len(r_new))
- float gamma = 2.2
- float Emin = 0.1∗cst.GeV
- Emax = np.empty(len(t_new))
- int eps = 1e-4
- int x0 = 10.∗cst.GeV
- float a = Emin
- int b = beta
- tuple c = (beta/(1+beta))∗cst.e∗np.sqrt(4∗np.pi∗nt∗cst.mp)/(10.∗cst.c)∗xhi_cr∗u_sh[ii]∗∗2∗r_new[ii]
- niter
- EMAX = max(Emax)
- int delta = 2.
- float tSed = tfree
- Ecr = np.logspace(np.log10(0.1∗cst.GeV), np.log10(100.∗cst.TeV), 100)
- tesc = np.empty(len(Ecr))
- figsize

  Model figure #.
- pc
- marker
- lw
- label
- GeV
- kyr

3.10.1 Function Documentation

3.10.1.1 df1dx()

```
def EscapeModel_protons.df1dx (
              x,
              const )
```

3.10.1.2 df2dx()

```
def EscapeModel_protons.df2dx (
              x,
              const )
```

3.10.1.3 f1()

```
def EscapeModel_protons.f1 (
              x,
              const )
```

3.10.1.4 f2()

```
def EscapeModel_protons.f2 (
              x,
              const )
```

3.10.1.5 Gettesc()

```
def EscapeModel_protons.Gettesc (
              E,
              delta )
```

3.10.1.6 InterpolatingSpline()

```
def EscapeModel_protons.InterpolatingSpline (
              X,
              Y )
```

3.10.1.7 InverseTrigonalMatrix()

```
def EscapeModel_protons.InverseTrigonalMatrix (
              T )
```

FUNCTIONS IN ORDER TO CREATE A GOOD SPLINE !!! #.

TriDiagonal matrix inversion function

3.10.1.8 NewtonRaphson()

```
def EscapeModel_protons.NewtonRaphson (
              f,
              df,
              x0,
              eps,
              const )
```

3.10.1.9 ProductMatrix()

```
def EscapeModel_protons.ProductMatrix (
              A,
              B )
```

3.10.2 Variable Documentation

3.10.2.1 a

```
float EscapeModel_protons.a = Emin
```

3.10.2.2 b

```
float EscapeModel_protons.b = beta
```

3.10.2.3 beta

```
float EscapeModel_protons.beta = 1
```

3.10.2.4 c

```
EscapeModel_protons.c = (beta/(1+beta))*cst.e*np.sqrt(4*np.pi*nt*cst.mp)/(10.*cst.c)*xhi_cr*u↩
_sh[ii]**2*r_new[ii]
```

3.10.2.5 C06

```
int EscapeModel_protons.C06 = 1
```

3.10.2.6 delta

```
int EscapeModel_protons.delta = 2.
```

3.10.2.7 E51

```
int EscapeModel_protons.E51 = 1
```

3.10.2.8 Ecr

```
EscapeModel_protons.Ecr = np.logspace(np.log10(0.1*cst.GeV), np.log10(100.*cst.TeV), 100)
```

3.10.2.9 Emax

```
EscapeModel_protons.Emax = np.empty(len(t_new))
```

3.10.2.10 EMAX

```
EscapeModel_protons.EMAX = max(Emax)
```

3.10.2.11 Emin

```
float EscapeModel_protons.Emin = 0.1*cst.GeV
```

3.10.2.12 eps

```
int EscapeModel_protons.eps = 1e-4
```

3.10.2.13 f_SNR

```
def EscapeModel_protons.f_SNR = InterpolatingSpline(logt, logR)
```

3.10.2.14 figsize

```
EscapeModel_protons.figsize
```

Model figure #.

3.10.2.15 gamma

```
float EscapeModel_protons.gamma = 2.2
```

3.10.2.16 GeV

```
EscapeModel_protons.GeV
```

3.10.2.17 kyr

```
EscapeModel_protons.kyr
```

3.10.2.18 label

```
EscapeModel_protons.label
```

3.10.2.19 logR

```
EscapeModel_protons.logR = np.empty(len(R))
```

3.10.2.20 logr_new

```
EscapeModel_protons.logr_new = np.empty(len(logt_new))
```

3.10.2.21 logt

```
EscapeModel_protons.logt = np.empty(len(t))
```

3.10.2.22 logt_new

```
EscapeModel_protons.logt_new = np.linspace(logt[0], logt[-1], 100)
```

3.10.2.23 lw

```
EscapeModel_protons.lw
```

3.10.2.24 marker

```
EscapeModel_protons.marker
```

3.10.2.25 Mej

```
int EscapeModel_protons.Mej = 1
```

3.10.2.26 niter

```
EscapeModel_protons.niter
```

3.10.2.27 nt

```
float EscapeModel_protons.nt = 0.35
```

3.10.2.28 pc

```
EscapeModel_protons.pc
```

3.10.2.29 phi_c

```
int EscapeModel_protons.phi_c = 1
```

3.10.2.30 R

```
EscapeModel_protons.R = np.array([R_ini, R_free, R_PDS, R_MCS, R_merge])
```

3.10.2.31 R_free

```
float EscapeModel_protons.R_free = 5.0*(E51/nt)**(1./5)*(1 - (0.05*Mej**(5./6))/(E51**0.↩
5*nt**(1./3)*(tfree/cst.kyr)))**(2./5)*(tfree/cst.kyr)**(2./5)*cst.pc
```

3.10.2.32 R_ini

```
float EscapeModel_protons.R_ini = R_free*(tini/tfree)**(1.)
```

3.10.2.33 R_MCS

```
float EscapeModel_protons.R_MCS = R_PDS*(tMCS/tPDS)**(3./10)
```

3.10.2.34 R_merge

```
float EscapeModel_protons.R_merge = R_MCS*(tmerge/tMCS)**(1./4)
```

3.10.2.35 r_new

```
EscapeModel_protons.r_new = np.empty(len(logr_new))
```

3.10.2.36 R_PDS

```
float EscapeModel_protons.R_PDS = 5.0*(E51/nt)**(1./5)*(1 - (0.05*Mej**(5./6))/(E51**0.5*nt**(1./3)*(t↩
PDS/cst.kyr)))**(2./5)*(tPDS/cst.kyr)**(2./5)*cst.pc
```

3.10.2.37 t

```
EscapeModel_protons.t = np.array([tini, tfree, tPDS, tMCS, tmerge])
```

3.10.2.38 t_new

```
EscapeModel_protons.t_new = np.empty(len(logt_new))
```

3.10.2.39 tesc

```
EscapeModel_protons.tesc = np.empty(len(Ecr))
```

3.10.2.40 tfree

```
float EscapeModel_protons.tfree = 0.3*E51**(-0.5)*Mej*nt**(-1./3)*cst.kyr
```

3.10.2.41 tini

```
int EscapeModel_protons.tini = 1e-4*cst.kyr
```

FUNCTIONS IN ORDER TO MAKE OUR SNR EXPAND IN THE ISM #.

We define the characteristic times of our problem

3.10.2.42 tmax

```
EscapeModel_protons.tmax = min(tMCS, tmerge)
```

3.10.2.43 tMCS

```
float EscapeModel_protons.tMCS = min(61*vej8**3/(xhi_m**(9./14)*nt**(3./7)*E51**(3./14)), 476./(xhi↩
_m*phi_c)**(9./14))*tPDS
```

3.10.2.44 tmerge

```
int EscapeModel_protons.tmerge = 153.*(E51**(1./14)*nt**(1./7)*xhi_m**(3./14)/(beta*C06))**(10./7)*t↩
PDS
```

3.10.2.45 tPDS

```
float EscapeModel_protons.tPDS = np.exp(-1.)*3.61e4*E51**(3./14)/(xhi_m**(5./14)*nt**(4./7))*cst.↩
yr
```

3.10.2.46 tSed

```
float EscapeModel_protons.tSed = tfree
```

3.10.2.47 u_sh

```
EscapeModel_protons.u_sh = np.empty(len(r_new))
```

3.10.2.48 vej8

```
int EscapeModel_protons.vej8 = 10.*(E51/Mej)**(0.5)
```

3.10.2.49 x0

```
int EscapeModel_protons.x0 = 10.*cst.GeV
```

3.10.2.50 xhi_cr

```
float EscapeModel_protons.xhi_cr = 0.1
```

3.10.2.51 xhi_m

```
int EscapeModel_protons.xhi_m = 1
```

3.11 EscapeModel_protons_2 Namespace Reference

Functions

- def InverseTrigonalMatrix (T)

  FUNCTIONS IN ORDER TO CREATE A GOOD SPLINE !!! #.
- def ProductMatrix (A, B)
- def InterpolatingSpline (X, Y)
- def f1 (x, const)
- def df1dx (x, const)
- def f2 (x, const)
- def df2dx (x, const)
- def NewtonRaphson (f, df, x0, eps, const)
- def getSNR (phase, size=100)
- def Gettesc (E, delta, tSed, EMAX, Emin=0.1 ∗cst.GeV)
- def getEmax (t_new, u_sh, r_new, phase, gamma=2.2, Emin=0.1 ∗cst.GeV, eps=1e-4, x0=10.∗cst.GeV)

Variables

- Ecr = np.logspace(np.log10(0.1∗cst.GeV), np.log10(100.∗cst.TeV), 1000)
- def SNR_HII = getSNR(ism.HII, size = 100)
- def emax_HII
- def SNR_WIM = getSNR(ism.WIM, size = 100)
- def emax_WIM
- def SNR_WNM = getSNR(ism.WNM, size = 100)
- def emax_WNM
- def SNR_CNM = getSNR(ism.CNM, size = 100)
- def emax_CNM
- def SNR_DiM = getSNR(ism.DiM, size = 100)
- def emax_DiM
- int delta = 2.
- tesc_HII = np.empty(len(Ecr))
- tesc_WIM = np.empty(len(Ecr))
- tesc_WNM = np.empty(len(Ecr))
- tesc_CNM = np.empty(len(Ecr))
- tesc_DiM = np.empty(len(Ecr))
- tesc_HII_3 = np.empty(len(Ecr))
- tesc_WIM_3 = np.empty(len(Ecr))
- tesc_WNM_3 = np.empty(len(Ecr))
- tesc_CNM_3 = np.empty(len(Ecr))

- tesc_DiM_3 = np.empty(len(Ecr))
- int size_x = 4
- float size_y = 3.5
- int sub_x = 2
- int sub_y = 1
- fig = plt.figure(figsize=(size_x∗sub_x,size_y∗sub_y))
- gs = gridspec.GridSpec(ncols= sub_x, nrows = sub_y, figure = fig)
- wspace
- hspace
- ax0 = fig.add_subplot(gs[0])
- GeV
- c
- label
- loc
- ncol
- bbox_to_anchor
- ax1 = fig.add_subplot(gs[1])
- kyr
- ls
- pad

3.11.1 Function Documentation

3.11.1.1 df1dx()

```
def EscapeModel_protons_2.df1dx (
              x,
              const )
```

3.11.1.2 df2dx()

```
def EscapeModel_protons_2.df2dx (
              x,
              const )
```

3.11.1.3 f1()

```
def EscapeModel_protons_2.f1 (
              x,
              const )
```

3.11.1.4 f2()

```
def EscapeModel_protons_2.f2 (
              x,
              const )
```

3.11.1.5 getEmax()

```
def EscapeModel_protons_2.getEmax (
              t_new,
              u_sh,
              r_new,
              phase,
              gamma = 2.2,
              Emin = 0.1*cst.GeV,
              eps = 1e-4,
              x0 = 10.*cst.GeV )
```

3.11.1.6 getSNR()

```
def EscapeModel_protons_2.getSNR (
              phase,
              size = 100 )
```

3.11.1.7 Gettesc()

```
def EscapeModel_protons_2.Gettesc (
              E,
              delta,
              tSed,
              EMAX,
              Emin = 0.1*cst.GeV )
```

3.11.1.8 InterpolatingSpline()

```
def EscapeModel_protons_2.InterpolatingSpline (
              X,
              Y )
```

3.11.1.9 InverseTrigonalMatrix()

```
def EscapeModel_protons_2.InverseTrigonalMatrix (
              T )
```

FUNCTIONS IN ORDER TO CREATE A GOOD SPLINE !!! #.

TriDiagonal matrix inversion function

3.11.1.10 NewtonRaphson()

```
def EscapeModel_protons_2.NewtonRaphson (
              f,
              df,
              x0,
              eps,
              const )
```

3.11.1.11 ProductMatrix()

```
def EscapeModel_protons_2.ProductMatrix (
              A,
              B )
```

3.11.2 Variable Documentation

3.11.2.1 ax0

```
EscapeModel_protons_2.ax0 = fig.add_subplot(gs[0])
```

3.11.2.2 ax1

```
EscapeModel_protons_2.ax1 = fig.add_subplot(gs[1])
```

3.11.2.3 bbox_to_anchor

```
EscapeModel_protons_2.bbox_to_anchor
```

3.11.2.4 c

```
EscapeModel_protons_2.c
```

3.11.2.5 delta

```
int EscapeModel_protons_2.delta = 2.
```

3.11.2.6 Ecr

```
EscapeModel_protons_2.Ecr = np.logspace(np.log10(0.1*cst.GeV), np.log10(100.*cst.TeV), 1000)
```

3.11.2.7 emax_CNM

```
def EscapeModel_protons_2.emax_CNM
```

Initial value:

```
1 =  getEmax(SNR_CNM.get("t_SNR"), SNR_CNM.get("u_sh"), SNR_CNM.get("R_SNR"), ism.CNM,
2                   gamma = 2.2, Emin = 0.1*cst.GeV, eps = 1e-4, x0 = 10.*cst.GeV)
```

3.11.2.8 emax_DiM

```
def EscapeModel_protons_2.emax_DiM
```

Initial value:

```
1 =  getEmax(SNR_DiM.get("t_SNR"), SNR_DiM.get("u_sh"), SNR_DiM.get("R_SNR"), ism.DiM,
2                   gamma = 2.2, Emin = 0.1*cst.GeV, eps = 1e-4, x0 = 10.*cst.GeV)
```

3.11.2.9 emax_HII

```
def EscapeModel_protons_2.emax_HII
```

Initial value:

```
1 =  getEmax(SNR_HII.get("t_SNR"), SNR_HII.get("u_sh"), SNR_HII.get("R_SNR"), ism.HII,
2                   gamma = 2.2, Emin = 0.1*cst.GeV, eps = 1e-4, x0 = 10.*cst.GeV)
```

3.11.2.10 emax_WIM

```
def EscapeModel_protons_2.emax_WIM
```

Initial value:

```
1 =  getEmax(SNR_WIM.get("t_SNR"), SNR_WIM.get("u_sh"), SNR_WIM.get("R_SNR"), ism.WIM,
2                   gamma = 2.2, Emin = 0.1*cst.GeV, eps = 1e-4, x0 = 10.*cst.GeV)
```

3.11.2.11 emax_WNM

```
def EscapeModel_protons_2.emax_WNM
```

Initial value:

```
1 =  getEmax(SNR_WNM.get("t_SNR"), SNR_WNM.get("u_sh"), SNR_WNM.get("R_SNR"), ism.WNM,
2                   gamma = 2.2, Emin = 0.1*cst.GeV, eps = 1e-4, x0 = 10.*cst.GeV)
```

3.11.2.12 fig

```
EscapeModel_protons_2.fig = plt.figure(figsize=(size_x*sub_x,size_y*sub_y))
```

3.11.2.13 GeV

```
EscapeModel_protons_2.GeV
```

3.11.2.14 gs

```
EscapeModel_protons_2.gs = gridspec.GridSpec(ncols= sub_x, nrows = sub_y, figure = fig )
```

3.11.2.15 hspace

```
EscapeModel_protons_2.hspace
```

3.11.2.16 kyr

```
EscapeModel_protons_2.kyr
```

3.11.2.17 label

```
EscapeModel_protons_2.label
```

3.11.2.18 loc

```
EscapeModel_protons_2.loc
```

3.11.2.19 ls

```
EscapeModel_protons_2.ls
```

3.11.2.20 ncol

```
EscapeModel_protons_2.ncol
```

3.11.2.21 pad

```
EscapeModel_protons_2.pad
```

3.11.2.22 size_x

```
int EscapeModel_protons_2.size_x = 4
```

3.11.2.23 size_y

```
float EscapeModel_protons_2.size_y = 3.5
```

3.11.2.24 SNR_CNM

```
def EscapeModel_protons_2.SNR_CNM = getSNR(ism.CNM, size = 100)
```

3.11.2.25 SNR_DiM

```
def EscapeModel_protons_2.SNR_DiM = getSNR(ism.DiM, size = 100)
```

3.11.2.26 SNR_HII

```
def EscapeModel_protons_2.SNR_HII = getSNR(ism.HII, size = 100)
```

3.11.2.27 SNR_WIM

```
def EscapeModel_protons_2.SNR_WIM = getSNR(ism.WIM, size = 100)
```

3.11.2.28 SNR_WNM

```
def EscapeModel_protons_2.SNR_WNM = getSNR(ism.WNM, size = 100)
```

3.11.2.29 sub_x

```
int EscapeModel_protons_2.sub_x = 2
```

3.11.2.30 sub_y

```
int EscapeModel_protons_2.sub_y = 1
```

3.11.2.31 tesc_CNM

```
EscapeModel_protons_2.tesc_CNM = np.empty(len(Ecr))
```

3.11.2.32 tesc_CNM_3

```
EscapeModel_protons_2.tesc_CNM_3 = np.empty(len(Ecr))
```

3.11.2.33 tesc_DiM

```
EscapeModel_protons_2.tesc_DiM = np.empty(len(Ecr))
```

3.11.2.34 tesc_DiM_3

```
EscapeModel_protons_2.tesc_DiM_3 = np.empty(len(Ecr))
```

3.11.2.35 tesc_HII

```
EscapeModel_protons_2.tesc_HII = np.empty(len(Ecr))
```

3.11.2.36 tesc_HII_3

```
EscapeModel_protons_2.tesc_HII_3 = np.empty(len(Ecr))
```

3.11.2.37 tesc_WIM

```
EscapeModel_protons_2.tesc_WIM = np.empty(len(Ecr))
```

3.11.2.38 tesc_WIM_3

```
EscapeModel_protons_2.tesc_WIM_3 = np.empty(len(Ecr))
```

3.11.2.39 tesc_WNM

```
EscapeModel_protons_2.tesc_WNM = np.empty(len(Ecr))
```

3.11.2.40 tesc_WNM_3

```
EscapeModel_protons_2.tesc_WNM_3 = np.empty(len(Ecr))
```

3.11.2.41 wspace

```
EscapeModel_protons_2.wspace
```

3.12 freader Namespace Reference

Functions

- def search (file_name, variable)

3.12.1 Function Documentation

3.12.1.1 search()

```
def freader.search (
              file_name,
              variable )
```

3.13 fwritter Namespace Reference

Functions

- def search (file_name, variable)
- def fileWrite (file_name, variables={}, path='./', ext='.dat')
- def write1D (file_name, nx=None, ne=None, variable=None, path="./")
- def write2D (file_name, nx=None, ny=None, ne=None, variable=None, path="./")
- def write1Daxis (file_name, variable=None, nx=None, path="./")

3.13.1 Function Documentation

3.13.1.1 fileWrite()

```
def fwritter.fileWrite (
              file_name,
              variables = {},
              path = './',
              ext = '.dat' )
```

3.13.1.2 search()

```
def fwritter.search (
              file_name,
              variable )
```

3.13.1.3 write1D()

```
def fwritter.write1D (
              file_name,
              nx = None,
              ne = None,
              variable = None,
              path = "./" )
```

3.13.1.4 write1Daxis()

```
def fwritter.write1Daxis (
              file_name,
              variable = None,
              nx = None,
              path = "./" )
```

3.13.1.5 write2D()

```
def fwritter.write2D (
              file_name,
              nx = None,
              ny = None,
              ne = None,
              variable = None,
              path = "./" )
```

3.14 gaussian_subNormalization Namespace Reference

Functions

- def gauss (t, sig, mu)

Variables

- float tmin = 0.01
- float tesc = 25.23
- int tmax = 2∗tesc - tmin
- int sig = 2
- int mu = 25
- int Nc = 1e6
- tc = np.linspace(tmin, tmax, Nc)
- int Nv = 100
- ta = np.linspace(tmin, tmax, Nv)
- int r = Nc/Nv
- gauss_c = np.zeros(len(tc))
- gauss_a = np.zeros(len(ta))
- int C_c = 0.
- int C_a = 0.
- color
- c

3.14.1 Function Documentation

3.14.1.1 gauss()

```
def gaussian_subNormalization.gauss (
              t,
              sig,
              mu )
```

3.14.2 Variable Documentation

3.14.2.1 c

```
gaussian_subNormalization.c
```

3.14.2.2 C_a

```
int gaussian_subNormalization.C_a = 0.
```

3.14.2.3 C_c

```
int gaussian_subNormalization.C_c = 0.
```

3.14.2.4 color

```
gaussian_subNormalization.color
```

3.14.2.5 gauss_a

```
gaussian_subNormalization.gauss_a = np.zeros(len(ta))
```

3.14.2.6 gauss_c

```
gaussian_subNormalization.gauss_c = np.zeros(len(tc))
```

3.14.2.7 mu

```
int gaussian_subNormalization.mu = 25
```

3.14.2.8 Nc

```
int gaussian_subNormalization.Nc = 1e6
```

3.14.2.9 Nv

```
int gaussian_subNormalization.Nv = 100
```

3.14.2.10 r

```
int gaussian_subNormalization.r = Nc/Nv
```

3.14.2.11 sig

```
int gaussian_subNormalization.sig = 2
```

3.14.2.12 ta

```
gaussian_subNormalization.ta = np.linspace(tmin, tmax, Nv)
```

3.14.2.13 tc

```
gaussian_subNormalization.tc = np.linspace(tmin, tmax, Nc)
```

3.14.2.14 tesc

```
gaussian_subNormalization.tesc = 25.23
```

3.14.2.15 tmax

```
int gaussian_subNormalization.tmax = 2*tesc - tmin
```

3.14.2.16 tmin

```
float gaussian_subNormalization.tmin = 0.01
```

3.15 mathmethods Namespace Reference

Functions

- def Cubic3 (a, b, c, d)
- def findF (a, b, c)
- def findG (a, b, c, d)
- def findH (g, f)
- def cardano3 (a, b, c)
- def histogram (data, xi, xf, nbin, scale, normalization)
- def g (f, t)
- def simpson_log (f, a, b, N)
- def glin (f, t)
- def simpson_lin (f, a, b, N)
- def g1 (x, xt, l)
- def g2 (x, xt, l)
- def f (x, xt, l, v1, v2)
- def shape (X, Amp, Xmin=0., Xmax=1., sig_Xmin=0.1, sig_Xmax=0.2)
- def multishape (X, Amp, Xmin, Xmax, sig)
- def SmoothPhaseTransition (X, E, phases, smooth_width)

3.15.1 Function Documentation

3.15.1.1 cardano3()

```
def mathmethods.cardano3 (
                a,
                b,
                c )
```

3.15.1.2 Cubic3()

```
def mathmethods.Cubic3 (
                a,
                b,
                c,
                d )
```

3.15.1.3 f()

```
def mathmethods.f (
                x,
                xt,
                l,
                v1,
                v2 )
```

3.15.1.4 findF()

```
def mathmethods.findF (
              a,
              b,
              c )
```

3.15.1.5 findG()

```
def mathmethods.findG (
              a,
              b,
              c,
              d )
```

3.15.1.6 findH()

```
def mathmethods.findH (
              g,
              f )
```

3.15.1.7 g()

```
def mathmethods.g (
              f,
              t )
```

3.15.1.8 g1()

```
def mathmethods.g1 (
              x,
              xt,
              l )
```

3.15.1.9 g2()

```
def mathmethods.g2 (
              x,
              xt,
              l )
```

3.15.1.10 glin()

```
def mathmethods.glin (
              f,
              t )
```

3.15.1.11 histogram()

```
def mathmethods.histogram (
              data,
              xi,
              xf,
              nbin,
              scale,
              normalization )
```

3.15.1.12 multishape()

```
def mathmethods.multishape (
              X,
              Amp,
              Xmin,
              Xmax,
              sig )
```

3.15.1.13 shape()

```
def mathmethods.shape (
              X,
              Amp,
              Xmin = 0.,
              Xmax = 1.,
              sig_Xmin = 0.1,
              sig_Xmax = 0.2 )
```

3.15.1.14 simpson_lin()

```
def mathmethods.simpson_lin (
              f,
              a,
              b,
              N )
```

3.15.1.15 simpson_log()

```
def mathmethods.simpson_log (
                f,
                a,
                b,
                N )
```

3.15.1.16 SmoothPhaseTransition()

```
def mathmethods.SmoothPhaseTransition (
                X,
                E,
                phases,
                smooth_width )
```

3.16 namelist Namespace Reference

Functions

- def getVA (E, phase)
- def getDamping (E, phase)

Variables

- string folder_name = "Test_standard_full"

  OUTPUT FOLDER CREATOR #.
- string folder_path = "../WorkFolder/"
- string total_path = folder_path+folder_name
- int NX = 10

  GRID PARAMETERS #.
- int NE = 7
- int Xmin = 0.∗cst.pc
- int Xmax = 2000.∗cst.pc
- string xgridtype = "cartesian"
- float Emin = 0.99∗cst.GeV
- float Emax = 50.01∗cst.TeV
- string egridtype = "logspace"
- int box_center = 1000.∗cst.pc
- X = grid.grid(Xmin, Xmax, 2∗∗NX, xgridtype, s_center = box_center)
- E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)
- bool in_damping = True

  OTHER TERMS #.
- bool lz_damping = True
- bool nlld_damping = True
- int Pcr_1GeV = 1∗cst.eV
- int Pe_1GeV = 1e-2∗cst.eV
- string bdiff_model = "ISM_independant"

- list phases = [ ]

  ISM STRUCTURE #.
- list smooth_width_transition = [10.∗cst.pc, 3.∗cst.pc, 3.∗cst.pc, 10.∗cst.pc, 10.∗cst.pc, 3.∗cst.pc, 3.∗cst.pc, 10.∗cst.pc]
- T
- B
- ni
- nn
- nt
- Xi
- mi
- mn
- va
- gamma_in
- gamma_lz
- ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va, gamma_in = gamma_in, gamma_lz = gamma_lz)

3.16.1 Function Documentation

3.16.1.1 getDamping()

```
def namelist.getDamping (
              E,
              phase )
```

3.16.1.2 getVA()

```
def namelist.getVA (
              E,
              phase )
```

3.16.2 Variable Documentation

3.16.2.1 B

```
namelist.B
```

3.16.2.2 bdiff_model

```
string namelist.bdiff_model = "ISM_independant"
```

3.16.2.3 box_center

```
int namelist.box_center = 1000.*cst.pc
```

3.16.2.4 E

```
namelist.E = grid.grid(Emin, Emax, 2**NE, egridtype)
```

3.16.2.5 egridtype

```
string namelist.egridtype = "logspace"
```

3.16.2.6 Emax

```
float namelist.Emax = 50.01*cst.TeV
```

3.16.2.7 Emin

```
float namelist.Emin = 0.99*cst.GeV
```

3.16.2.8 folder_name

```
string namelist.folder_name = "Test_standard_full"
```

OUTPUT FOLDER CREATOR #.

Relative position of the ouput folder

3.16.2.9 folder_path

```
string namelist.folder_path = "../WorkFolder/"
```

3.16.2.10 gamma_in

```
namelist.gamma_in
```

3.16.2.11 gamma_lz

```
namelist.gamma_lz
```

3.16.2.12 in_damping

```
bool namelist.in_damping = True
```

OTHER TERMS #.

3.16.2.13 ism_values

```
namelist.ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va, gamma_in
= gamma_in, gamma_lz = gamma_lz)
```

3.16.2.14 lz_damping

```
bool namelist.lz_damping = True
```

3.16.2.15 mi

```
namelist.mi
```

3.16.2.16 mn

```
namelist.mn
```

3.16.2.17 NE

```
int namelist.NE = 7
```

3.16.2.18 ni

```
namelist.ni
```

3.16.2.19 nlld_damping

```
bool namelist.nlld_damping = True
```

3.16.2.20 nn

```
namelist.nn
```

3.16.2.21 nt

```
namelist.nt
```

3.16.2.22 NX

```
int namelist.NX = 10
```

GRID PARAMETERS #.

3.16.2.23 Pcr_1GeV

```
int namelist.Pcr_1GeV = 1*cst.eV
```

3.16.2.24 Pe_1GeV

```
int namelist.Pe_1GeV = 1e-2*cst.eV
```

3.16.2.25 phases

```
list namelist.phases = []
```

ISM STRUCTURE #.

3.16.2.26 smooth_width_transition

```
list namelist.smooth_width_transition = [10.*cst.pc, 3.*cst.pc, 3.*cst.pc, 10.*cst.pc, 10.*cst.↩
pc, 3.*cst.pc, 3.*cst.pc, 10.*cst.pc]
```

3.16.2.27 T

```
namelist.T
```

3.16.2.28 total_path

```
string namelist.total_path = folder_path+folder_name
```

3.16.2.29 va

```
namelist.va
```

3.16.2.30 X

```
namelist.X = grid.grid(Xmin, Xmax, 2**NX, xgridtype, s_center = box_center)
```

3.16.2.31 xgridtype

```
string namelist.xgridtype = "cartesian"
```

3.16.2.32 Xi

```
namelist.Xi
```

3.16.2.33 Xmax

```
int namelist.Xmax = 2000.*cst.pc
```

3.16.2.34 Xmin

```
int namelist.Xmin = 0.*cst.pc
```

3.17 namelist_adv Namespace Reference

Functions

- def getVA (E, phase)

Variables

- string folder_name = "advc_z_X12"

  OUTPUT FOLDER CREATOR #.
- string folder_path = "../../WorkFolder/Fiducial_tests_for_thesis/"
- string total_path = folder_path+folder_name
- int NX = 12

  GRID PARAMETERS #.
- int NE = 4
- int Xmin = 0.∗cst.pc
- int Xmax = 2000.∗cst.pc
- string xgridtype = "cartesian"
- int Emin = 10.∗cst.GeV
- int Emax = 10.∗cst.TeV
- string egridtype = "logspace"
- int box_center = 1000.∗cst.pc
- X
- E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)
- bool in_damping = True

  OTHER TERMS #.
- bool lz_damping = True
- bool nlld_damping = True
- int Pcr_1GeV = 1∗cst.eV
- int Pe_1GeV = 1∗cst.eV
- string bdiff_model = "ISM_independant"
- list phases = [ ]

  ISM STRUCTURE #.
- int smooth_width_transition = 10.∗cst.pc
- T
- B
- ni
- nn
- nt
- Xi
- mi
- mn
- va
- ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va)

3.17.1 Function Documentation

3.17.1.1 getVA()

```
def namelist_adv.getVA (
              E,
              phase )
```

3.17.2 Variable Documentation

3.17.2.1 B

```
namelist_adv.B
```

3.17.2.2 bdiff_model

```
string namelist_adv.bdiff_model = "ISM_independant"
```

3.17.2.3 box_center

```
int namelist_adv.box_center = 1000.*cst.pc
```

3.17.2.4 E

```
namelist_adv.E = grid.grid(Emin, Emax, 2**NE, egridtype)
```

3.17.2.5 egridtype

```
string namelist_adv.egridtype = "logspace"
```

3.17.2.6 Emax

```
int namelist_adv.Emax = 10.*cst.TeV
```

3.17.2.7 Emin

```
int namelist_adv.Emin = 10.*cst.GeV
```

3.17.2.8 folder_name

```
string namelist_adv.folder_name = "advc_z_X12"
```

OUTPUT FOLDER CREATOR #.

Relative position of the ouput folder

3.17.2.9 folder_path

```
string namelist_adv.folder_path = "../../WorkFolder/Fiducial_tests_for_thesis/"
```

3.17.2.10 in_damping

```
bool namelist_adv.in_damping = True
```

OTHER TERMS #.

3.17.2.11 ism_values

```
namelist_adv.ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va)
```

3.17.2.12 lz_damping

```
bool namelist_adv.lz_damping = True
```

3.17.2.13 mi

```
namelist_adv.mi
```

3.17.2.14 mn

```
namelist_adv.mn
```

3.17.2.15 NE

```
int namelist_adv.NE = 4
```

3.17.2.16 ni

```
namelist_adv.ni
```

3.17.2.17 nlld_damping

```
bool namelist_adv.nlld_damping = True
```

3.17.2.18 nn

```
namelist_adv.nn
```

3.17.2.19 nt

```
namelist_adv.nt
```

3.17.2.20 NX

```
int namelist_adv.NX = 12
```

GRID PARAMETERS #.

3.17.2.21 Pcr_1GeV

```
int namelist_adv.Pcr_1GeV = 1*cst.eV
```

3.17.2.22 Pe_1GeV

```
int namelist_adv.Pe_1GeV = 1*cst.eV
```

3.17.2.23 phases

```
list namelist_adv.phases = []
```

ISM STRUCTURE #.

3.17.2.24 smooth_width_transition

```
int namelist_adv.smooth_width_transition = 10.*cst.pc
```

3.17.2.25 T

```
namelist_adv.T
```

3.17.2.26 total_path

```
string namelist_adv.total_path = folder_path+folder_name
```

3.17.2.27 va

```
namelist_adv.va
```

3.17.2.28 X

```
namelist_adv.X
```

Initial value:

```
1 =  grid.grid(Xmin, Xmax, 2**NX, xgridtype,
2               s_center = box_center, width = 200.*cst.pc, smooth = 20.*cst.pc, dXmin = 1.*cst.pc)
```

3.17.2.29 xgridtype

```
string namelist_adv.xgridtype = "cartesian"
```

3.17.2.30 Xi

```
namelist_adv.Xi
```

3.17.2.31 Xmax

```
int namelist_adv.Xmax = 2000.*cst.pc
```

3.17.2.32 Xmin

```
int namelist_adv.Xmin = 0.*cst.pc
```

3.18 namelist_adve Namespace Reference

Functions

- def getVA (E, phase)

Variables

- string folder_name = "adv_e_X6"

  OUTPUT FOLDER CREATOR #.
- string folder_path = "../../WorkFolder/Fiducial_tests_for_thesis/"
- string total_path = folder_path+folder_name
- int NX = 6

  GRID PARAMETERS #.
- int NE = 6
- int Xmin = 0.∗cst.pc
- int Xmax = 2000.∗cst.pc
- string xgridtype = "cartesian"
- int Emin = 10.∗cst.GeV
- int Emax = 10.∗cst.TeV
- string egridtype = "logspace"
- int box_center = 1000.∗cst.pc
- X
- E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)
- bool in_damping = True

OTHER TERMS #.

- bool lz_damping = True
- bool nlld_damping = True
- int Pcr_1GeV = 1∗cst.eV
- int Pe_1GeV = 1∗cst.eV
- string bdiff_model = "ISM_independant"
- list phases = [ ]

ISM STRUCTURE #.

- int smooth_width_transition = 10.∗cst.pc
- T
- B
- ni
- nn
- nt
- Xi
- mi
- mn
- va
- ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va)

3.18.1 Function Documentation

3.18.1.1 getVA()

```
def namelist_adve.getVA (
              E,
              phase )
```

3.18.2 Variable Documentation

3.18.2.1 B

```
namelist_adve.B
```

3.18.2.2 bdiff_model

```
string namelist_adve.bdiff_model = "ISM_independant"
```

3.18.2.3 box_center

```
int namelist_adve.box_center = 1000.*cst.pc
```

3.18.2.4 E

```
namelist_adve.E = grid.grid(Emin, Emax, 2**NE, egridtype)
```

3.18.2.5 egridtype

```
string namelist_adve.egridtype = "logspace"
```

3.18.2.6 Emax

```
int namelist_adve.Emax = 10.*cst.TeV
```

3.18.2.7 Emin

```
int namelist_adve.Emin = 10.*cst.GeV
```

3.18.2.8 folder_name

```
string namelist_adve.folder_name = "adv_e_X6"
```

OUTPUT FOLDER CREATOR #.

Relative position of the ouput folder

3.18.2.9 folder_path

```
string namelist_adve.folder_path = "../../WorkFolder/Fiducial_tests_for_thesis/"
```

3.18.2.10 in_damping

```
bool namelist_adve.in_damping = True
```

OTHER TERMS #.

3.18.2.11 ism_values

```
namelist_adve.ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va)
```

3.18.2.12 lz_damping

```
bool namelist_adve.lz_damping = True
```

3.18.2.13 mi

```
namelist_adve.mi
```

3.18.2.14 mn

```
namelist_adve.mn
```

3.18.2.15 NE

```
int namelist_adve.NE = 6
```

3.18.2.16 ni

```
namelist_adve.ni
```

3.18.2.17 nlld_damping

```
bool namelist_adve.nlld_damping = True
```

3.18.2.18 nn

```
namelist_adve.nn
```

3.18.2.19 nt

```
namelist_adve.nt
```

3.18.2.20 NX

```
int namelist_adve.NX = 6
```

GRID PARAMETERS #.

3.18.2.21 Pcr_1GeV

```
int namelist_adve.Pcr_1GeV = 1*cst.eV
```

3.18.2.22 Pe_1GeV

```
int namelist_adve.Pe_1GeV = 1*cst.eV
```

3.18.2.23 phases

```
list namelist_adve.phases = []
```

ISM STRUCTURE #.

3.18.2.24 smooth_width_transition

```
int namelist_adve.smooth_width_transition = 10.*cst.pc
```

3.18.2.25 T

```
namelist_adve.T
```

3.18.2.26 total_path

```
string namelist_adve.total_path = folder_path+folder_name
```

3.18.2.27 va

```
namelist_adve.va
```

3.18.2.28 X

```
namelist_adve.X
```

Initial value:

```
1 =  grid.grid(Xmin, Xmax, 2**NX, xgridtype,
2              s_center = box_center, width = 200.*cst.pc, smooth = 20.*cst.pc, dXmin = 1.*cst.pc)
```

3.18.2.29 xgridtype

```
string namelist_adve.xgridtype = "cartesian"
```

3.18.2.30 Xi

```
namelist_adve.Xi
```

3.18.2.31 Xmax

```
int namelist_adve.Xmax = 2000.*cst.pc
```

3.18.2.32 Xmin

```
int namelist_adve.Xmin = 0.*cst.pc
```

3.19 namelist_advst Namespace Reference

Functions

- def getVA (E, phase)

Variables

- string folder_name = "adv_sss_E6"

  OUTPUT FOLDER CREATOR #.
- string folder_path = "../../WorkFolder/Fiducial_tests_for_thesis/"
- string total_path = folder_path+folder_name
- int NX = 4

  GRID PARAMETERS #.
- int NE = 6
- int Xmin = 0.∗cst.pc
- int Xmax = 2000.∗cst.pc
- string xgridtype = "cartesian"
- int Emin = 10.∗cst.GeV
- int Emax = 10.∗cst.TeV
- string egridtype = "logspace"
- int box_center = 1000.∗cst.pc
- X
- E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)
- bool in_damping = True

  OTHER TERMS #.
- bool lz_damping = True
- bool nlld_damping = True
- int Pcr_1GeV = 1∗cst.eV
- int Pe_1GeV = 1∗cst.eV
- string bdiff_model = "ISM_independant"
- list phases = [ ]

  ISM STRUCTURE #.
- int smooth_width_transition = 10.∗cst.pc
- T
- B
- ni
- nn
- nt
- Xi
- mi
- mn
- va
- ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va)

3.19.1 Function Documentation

3.19.1.1 getVA()

```
def namelist_advst.getVA (
              E,
              phase )
```

3.19.2 Variable Documentation

3.19.2.1 B

```
namelist_advst.B
```

3.19.2.2 bdiff_model

```
string namelist_advst.bdiff_model = "ISM_independant"
```

3.19.2.3 box_center

```
int namelist_advst.box_center = 1000.*cst.pc
```

3.19.2.4 E

```
namelist_advst.E = grid.grid(Emin, Emax, 2**NE, egridtype)
```

3.19.2.5 egridtype

```
string namelist_advst.egridtype = "logspace"
```

3.19.2.6 Emax

```
int namelist_advst.Emax = 10.*cst.TeV
```

3.19.2.7 Emin

```
int namelist_advst.Emin = 10.*cst.GeV
```

3.19.2.8 folder_name

```
string namelist_advst.folder_name = "adv_sss_E6"
```

OUTPUT FOLDER CREATOR #.

Relative position of the ouput folder

3.19.2.9 folder_path

```
string namelist_advst.folder_path = "../../WorkFolder/Fiducial_tests_for_thesis/"
```

3.19.2.10 in_damping

```
bool namelist_advst.in_damping = True
```

OTHER TERMS #.

3.19.2.11 ism_values

```
namelist_advst.ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va)
```

3.19.2.12 lz_damping

```
bool namelist_advst.lz_damping = True
```

3.19.2.13 mi

```
namelist_advst.mi
```

3.19.2.14 mn

```
namelist_advst.mn
```

3.19.2.15 NE

```
int namelist_advst.NE = 6
```

3.19.2.16 ni

```
namelist_advst.ni
```

3.19.2.17 nlld_damping

```
bool namelist_advst.nlld_damping = True
```

3.19.2.18 nn

```
namelist_advst.nn
```

3.19.2.19 nt

```
namelist_advst.nt
```

3.19.2.20 NX

```
int namelist_advst.NX = 4
```

GRID PARAMETERS #.

3.19.2.21 Pcr_1GeV

```
int namelist_advst.Pcr_1GeV = 1*cst.eV
```

3.19.2.22 Pe_1GeV

```
int namelist_advst.Pe_1GeV = 1*cst.eV
```

3.19.2.23 phases

```
list namelist_advst.phases = []
```

ISM STRUCTURE #.

3.19.2.24 smooth_width_transition

```
int namelist_advst.smooth_width_transition = 10.*cst.pc
```

3.19.2.25 T

```
namelist_advst.T
```

3.19.2.26 total_path

```
string namelist_advst.total_path = folder_path+folder_name
```

3.19.2.27 va

```
namelist_advst.va
```

3.19.2.28 X

```
namelist_advst.X
```

Initial value:

```
1 =  grid.grid(Xmin, Xmax, 2**NX, xgridtype,
2               s_center = box_center, width = 200.*cst.pc, smooth = 20.*cst.pc, dXmin = 1.*cst.pc)
```

3.19.2.29 xgridtype

```
string namelist_advst.xgridtype = "cartesian"
```

3.19.2.30 Xi

```
namelist_advst.Xi
```

3.19.2.31 Xmax

```
int namelist_advst.Xmax = 2000.*cst.pc
```

3.19.2.32 Xmin

```
int namelist_advst.Xmin = 0.*cst.pc
```

3.20 namelist_diff Namespace Reference

Functions

- def getVA (E, phase)

Variables

- string folder_name = "diff_z_X12"

  OUTPUT FOLDER CREATOR #.
- string folder_path = "../../WorkFolder/Fiducial_tests_for_thesis/"
- string total_path = folder_path+folder_name
- int NX = 12

  GRID PARAMETERS #.
- int NE = 4
- int Xmin = 0.∗cst.pc
- int Xmax = 2000.∗cst.pc
- string xgridtype = "cartesian"
- int Emin = 10.∗cst.GeV
- int Emax = 10.∗cst.TeV
- string egridtype = "logspace"
- int box_center = 1000.∗cst.pc
- X
- E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)
- bool in_damping = True

  OTHER TERMS #.
- bool lz_damping = True
- bool nlld_damping = True
- int Pcr_1GeV = 1∗cst.eV
- int Pe_1GeV = 1∗cst.eV
- string bdiff_model = "ISM_independant"
- list phases = [ ]

  ISM STRUCTURE #.
- int smooth_width_transition = 10.∗cst.pc
- T
- B
- ni
- nn
- nt
- Xi
- mi
- mn
- va
- ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va)

3.20.1 Function Documentation

3.20.1.1 getVA()

```
def namelist_diff.getVA (
              E,
              phase )
```

3.20.2 Variable Documentation

3.20.2.1 B

```
namelist_diff.B
```

3.20.2.2 bdiff_model

```
string namelist_diff.bdiff_model = "ISM_independant"
```

3.20.2.3 box_center

```
int namelist_diff.box_center = 1000.*cst.pc
```

3.20.2.4 E

```
namelist_diff.E = grid.grid(Emin, Emax, 2**NE, egridtype)
```

3.20.2.5 egridtype

```
string namelist_diff.egridtype = "logspace"
```

3.20.2.6 Emax

```
int namelist_diff.Emax = 10.*cst.TeV
```

3.20.2.7 Emin

```
int namelist_diff.Emin = 10.*cst.GeV
```

3.20.2.8 folder_name

```
string namelist_diff.folder_name = "diff_z_X12"
```

OUTPUT FOLDER CREATOR #.

Relative position of the ouput folder

3.20.2.9 folder_path

```
string namelist_diff.folder_path = "../../WorkFolder/Fiducial_tests_for_thesis/"
```

3.20.2.10 in_damping

```
bool namelist_diff.in_damping = True
```

OTHER TERMS #.

3.20.2.11 ism_values

```
namelist_diff.ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va)
```

3.20.2.12 lz_damping

```
bool namelist_diff.lz_damping = True
```

3.20.2.13 mi

```
namelist_diff.mi
```

3.20.2.14 mn

```
namelist_diff.mn
```

3.20.2.15 NE

```
int namelist_diff.NE = 4
```

3.20.2.16 ni

```
namelist_diff.ni
```

3.20.2.17 nlld_damping

```
bool namelist_diff.nlld_damping = True
```

3.20.2.18 nn

```
namelist_diff.nn
```

3.20.2.19 nt

```
namelist_diff.nt
```

3.20.2.20 NX

```
int namelist_diff.NX = 12
```

GRID PARAMETERS #.

3.20.2.21 Pcr_1GeV

```
int namelist_diff.Pcr_1GeV = 1*cst.eV
```

3.20.2.22 Pe_1GeV

```
int namelist_diff.Pe_1GeV = 1*cst.eV
```

3.20.2.23 phases

```
list namelist_diff.phases = []
```

ISM STRUCTURE #.

3.20.2.24 smooth_width_transition

```
int namelist_diff.smooth_width_transition = 10.*cst.pc
```

3.20.2.25 T

```
namelist_diff.T
```

3.20.2.26 total_path

```
string namelist_diff.total_path = folder_path+folder_name
```

3.20.2.27 va

```
namelist_diff.va
```

3.20.2.28 X

```
namelist_diff.X
```

Initial value:

```
1 =  grid.grid(Xmin, Xmax, 2**NX, xgridtype,
2               s_center = box_center, width = 200.*cst.pc, smooth = 20.*cst.pc, dXmin = 1.*cst.pc)
```

3.20.2.29 xgridtype

```
string namelist_diff.xgridtype = "cartesian"
```

3.20.2.30 Xi

```
namelist_diff.Xi
```

3.20.2.31 Xmax

```
int namelist_diff.Xmax = 2000.*cst.pc
```

3.20.2.32 Xmin

```
int namelist_diff.Xmin = 0.*cst.pc
```

3.21 namelist_uniform Namespace Reference

Functions

- def getVA (E, phase)
- def getDamping (E, phase)

Variables

- string folder_name = "WNM-CNM-DiM_all_dependant"

  OUTPUT FOLDER CREATOR #.
- string folder_path = "../../../../WorkFolder/Fiducial_tests_for_thesis_2/"
- string total_path = folder_path+folder_name
- int NX = 12

  GRID PARAMETERS #.
- int NE = 8
- int Xmin = 0.∗cst.pc
- int Xmax = 2000.∗cst.pc
- string xgridtype = "cartesian"
- float Emin = 0.99∗cst.GeV
- float Emax = 50.01∗cst.TeV
- string egridtype = "logspace"
- int box_center = 1000.∗cst.pc
- X = grid.grid(Xmin, Xmax, 2∗∗NX, xgridtype, s_center = box_center)
- E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)

- bool in_damping = True

  OTHER TERMS #.
- bool lz_damping = True
- bool nlld_damping = True
- int Pcr_1GeV = 1∗cst.eV
- int Pe_1GeV = 1e-2∗cst.eV
- string bdiff_model = "ISM_dependant"
- list phases = [ ]

  ISM STRUCTURE #.
- list smooth_width_transition = [10.∗cst.pc, 3.∗cst.pc, 3.∗cst.pc, 10.∗cst.pc, 10.∗cst.pc, 3.∗cst.pc, 3.∗cst.pc, 10.∗cst.pc]
- T
- B
- ni
- nn
- nt
- Xi
- mi
- mn
- va
- gamma_in
- gamma_lz
- ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va, gamma_in = gamma_in, gamma_lz = gamma_lz)

3.21.1 Function Documentation

3.21.1.1 getDamping()

```
def namelist_uniform.getDamping (
              E,
              phase )
```

3.21.1.2 getVA()

```
def namelist_uniform.getVA (
              E,
              phase )
```

3.21.2 Variable Documentation

3.21.2.1 B

```
namelist_uniform.B
```

3.21.2.2 bdiff_model

```
string namelist_uniform.bdiff_model = "ISM_dependant"
```

3.21.2.3 box_center

```
int namelist_uniform.box_center = 1000.*cst.pc
```

3.21.2.4 E

```
namelist_uniform.E = grid.grid(Emin, Emax, 2**NE, egridtype)
```

3.21.2.5 egridtype

```
string namelist_uniform.egridtype = "logspace"
```

3.21.2.6 Emax

```
float namelist_uniform.Emax = 50.01*cst.TeV
```

3.21.2.7 Emin

```
float namelist_uniform.Emin = 0.99*cst.GeV
```

3.21.2.8 folder_name

```
string namelist_uniform.folder_name = "WNM-CNM-DiM_all_dependant"
```

OUTPUT FOLDER CREATOR #.

Relative position of the ouput folder

3.21.2.9 folder_path

```
string namelist_uniform.folder_path = "../../../../WorkFolder/Fiducial_tests_for_thesis_2/"
```

3.21.2.10 gamma_in

```
namelist_uniform.gamma_in
```

3.21.2.11 gamma_lz

```
namelist_uniform.gamma_lz
```

3.21.2.12 in_damping

```
bool namelist_uniform.in_damping = True
```

OTHER TERMS #.

3.21.2.13 ism_values

```
namelist_uniform.ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va,
gamma_in = gamma_in, gamma_lz = gamma_lz)
```

3.21.2.14 lz_damping

```
bool namelist_uniform.lz_damping = True
```

3.21.2.15 mi

```
namelist_uniform.mi
```

3.21.2.16 mn

```
namelist_uniform.mn
```

3.21.2.17 NE

```
int namelist_uniform.NE = 8
```

3.21.2.18 ni

```
namelist_uniform.ni
```

3.21.2.19 nlld_damping

```
bool namelist_uniform.nlld_damping = True
```

3.21.2.20 nn

```
namelist_uniform.nn
```

3.21.2.21 nt

```
namelist_uniform.nt
```

3.21.2.22 NX

```
int namelist_uniform.NX = 12
```

GRID PARAMETERS #.

3.21.2.23 Pcr_1GeV

```
int namelist_uniform.Pcr_1GeV = 1*cst.eV
```

3.21.2.24 Pe_1GeV

```
int namelist_uniform.Pe_1GeV = 1e-2*cst.eV
```

3.21.2.25 phases

```
list namelist_uniform.phases = []
```

ISM STRUCTURE #.

3.21.2.26 smooth_width_transition

```
list namelist_uniform.smooth_width_transition = [10.*cst.pc, 3.*cst.pc, 3.*cst.pc, 10.*cst.pc,
10.*cst.pc, 3.*cst.pc, 3.*cst.pc, 10.*cst.pc]
```

3.21.2.27 T

```
namelist_uniform.T
```

3.21.2.28 total_path

```
string namelist_uniform.total_path = folder_path+folder_name
```

3.21.2.29 va

```
namelist_uniform.va
```

3.21.2.30 X

```
namelist_uniform.X = grid.grid(Xmin, Xmax, 2**NX, xgridtype, s_center = box_center)
```

3.21.2.31 xgridtype

```
string namelist_uniform.xgridtype = "cartesian"
```

3.21.2.32 Xi

```
namelist_uniform.Xi
```

3.21.2.33 Xmax

```
int namelist_uniform.Xmax = 2000.*cst.pc
```

3.21.2.34 Xmin

```
int namelist_uniform.Xmin = 0.*cst.pc
```

3.22 namelist_vdiff Namespace Reference

Functions

- def getVA (E, phase)

Variables

- string folder_name = "vdiff_z_X14"

  OUTPUT FOLDER CREATOR #.
- string folder_path = "../../WorkFolder/Fiducial_tests_for_thesis/"
- string total_path = folder_path+folder_name
- int NX = 14

  GRID PARAMETERS #.
- int NE = 4
- int Xmin = 0.∗cst.pc
- int Xmax = 2000.∗cst.pc
- string xgridtype = "cartesian"
- int Emin = 10.∗cst.GeV
- int Emax = 10.∗cst.TeV
- string egridtype = "logspace"
- int box_center = 1000.∗cst.pc
- X
- E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)
- bool in_damping = True

  OTHER TERMS #.
- bool lz_damping = True
- bool nlld_damping = True
- int Pcr_1GeV = 1∗cst.eV
- int Pe_1GeV = 1∗cst.eV
- string bdiff_model = "ISM_independant"
- list phases = [ ]

  ISM STRUCTURE #.
- int smooth_width_transition = 10.∗cst.pc
- T
- B
- ni
- nn
- nt
- Xi
- mi
- mn
- va
- ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va)

3.22.1 Function Documentation

3.22.1.1 getVA()

```
def namelist_vdiff.getVA (
              E,
              phase )
```

3.22.2 Variable Documentation

3.22.2.1 B

```
namelist_vdiff.B
```

3.22.2.2 bdiff_model

```
string namelist_vdiff.bdiff_model = "ISM_independant"
```

3.22.2.3 box_center

```
int namelist_vdiff.box_center = 1000.*cst.pc
```

3.22.2.4 E

```
namelist_vdiff.E = grid.grid(Emin, Emax, 2**NE, egridtype)
```

3.22.2.5 egridtype

```
string namelist_vdiff.egridtype = "logspace"
```

3.22.2.6 Emax

```
int namelist_vdiff.Emax = 10.*cst.TeV
```

3.22.2.7 Emin

```
int namelist_vdiff.Emin = 10.*cst.GeV
```

3.22.2.8 folder_name

```
string namelist_vdiff.folder_name = "vdiff_z_X14"
```

OUTPUT FOLDER CREATOR #.

Relative position of the ouput folder

3.22.2.9 folder_path

```
string namelist_vdiff.folder_path = "../../WorkFolder/Fiducial_tests_for_thesis/"
```

3.22.2.10 in_damping

```
bool namelist_vdiff.in_damping = True
```

OTHER TERMS #.

3.22.2.11 ism_values

```
namelist_vdiff.ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va)
```

3.22.2.12 lz_damping

```
bool namelist_vdiff.lz_damping = True
```

3.22.2.13 mi

```
namelist_vdiff.mi
```

3.22.2.14 mn

```
namelist_vdiff.mn
```

3.22.2.15 NE

```
int namelist_vdiff.NE = 4
```

3.22.2.16 ni

```
namelist_vdiff.ni
```

3.22.2.17 nlld_damping

```
bool namelist_vdiff.nlld_damping = True
```

3.22.2.18 nn

```
namelist_vdiff.nn
```

3.22.2.19 nt

```
namelist_vdiff.nt
```

3.22.2.20 NX

```
int namelist_vdiff.NX = 14
```

GRID PARAMETERS #.

3.22.2.21 Pcr_1GeV

```
int namelist_vdiff.Pcr_1GeV = 1*cst.eV
```

3.22.2.22 Pe_1GeV

```
int namelist_vdiff.Pe_1GeV = 1*cst.eV
```

3.22.2.23 phases

```
list namelist_vdiff.phases = []
```

ISM STRUCTURE #.

3.22.2.24 smooth_width_transition

```
int namelist_vdiff.smooth_width_transition = 10.*cst.pc
```

3.22.2.25 T

```
namelist_vdiff.T
```

3.22.2.26 total_path

```
string namelist_vdiff.total_path = folder_path+folder_name
```

3.22.2.27 va

```
namelist_vdiff.va
```

3.22.2.28 X

```
namelist_vdiff.X
```

Initial value:

```
1 =  grid.grid(Xmin, Xmax, 2**NX, xgridtype,
2               s_center = box_center, width = 200.*cst.pc, smooth = 20.*cst.pc, dXmin = 1.*cst.pc)
```

3.22.2.29 xgridtype

```
string namelist_vdiff.xgridtype = "cartesian"
```

3.22.2.30 Xi

```
namelist_vdiff.Xi
```

3.22.2.31 Xmax

```
int namelist_vdiff.Xmax = 2000.*cst.pc
```

3.22.2.32 Xmin

```
int namelist_vdiff.Xmin = 0.*cst.pc
```

3.23 Output_functions Namespace Reference

3.24 pcr_ip_2D Namespace Reference

Functions

- def readDataXE (file_name, NX, NE)
- def readAxis (file_name)
- def getData (var, file_number)
- def getTimeID (time_test, delta_t, t_ini, kind="linear")

Variables

- int t_ini = 0.∗cst.kyr
- int t_max = 200.∗cst.kyr
- float delta_t = 0.1∗cst.kyr
- int x_center = 1000.
- float time_test = 5.9∗cst.kyr
- def out_id = getTimeID(time_test, delta_t, t_ini)
- X
- E
- Pcr
- Ip
- EV
- XV
- sparse
- False
- indexing
- cmap = plt.get_cmap('jet')
- XV_log = XV/cst.pc
- EV_log = np.log10(EV/cst.GeV)
- ax0
- ax1
- ncols
- sharey
- figsize
- im0 = ax0.pcolormesh(XV_log-x_center, EV_log, np.log10(Pcr), cmap=cmap)
- ax
- cax
- label
- im1 = ax1.pcolormesh(XV_log-x_center, EV_log, np.log10(Ip), cmap=cmap)
- fontsize

3.24.1 Function Documentation

3.24.1.1 getData()

```
def pcr_ip_2D.getData (
              var,
              file_number )
```

3.24.1.2 getTimeID()

```
def pcr_ip_2D.getTimeID (
              time_test,
              delta_t,
              t_ini,
              kind = "linear" )
```

3.24.1.3 readAxis()

```
def pcr_ip_2D.readAxis (
              file_name )
```

3.24.1.4 readDataXE()

```
def pcr_ip_2D.readDataXE (
              file_name,
              NX,
              NE )
```

3.24.2 Variable Documentation

3.24.2.1 ax

```
pcr_ip_2D.ax
```

3.24.2.2 ax0

```
pcr_ip_2D.ax0
```

3.24.2.3 ax1

```
pcr_ip_2D.ax1
```

3.24.2.4 cax

```
pcr_ip_2D.cax
```

3.24.2.5 cmap

```
pcr_ip_2D.cmap = plt.get_cmap('jet')
```

3.24.2.6 delta_t

```
float pcr_ip_2D.delta_t = 0.1*cst.kyr
```

3.24.2.7 E

```
pcr_ip_2D.E
```

3.24.2.8 EV

```
pcr_ip_2D.EV
```

3.24.2.9 EV_log

```
pcr_ip_2D.EV_log = np.log10(EV/cst.GeV)
```

3.24.2.10 False

```
pcr_ip_2D.False
```

3.24.2.11 figsize

```
pcr_ip_2D.figsize
```

3.24.2.12 fontsize

```
pcr_ip_2D.fontsize
```

3.24.2.13 im0

```
pcr_ip_2D.im0 = ax0.pcolormesh(XV_log-x_center, EV_log, np.log10(Pcr), cmap=cmap)
```

3.24.2.14 im1

```
pcr_ip_2D.im1 = ax1.pcolormesh(XV_log-x_center, EV_log, np.log10(Ip), cmap=cmap)
```

3.24.2.15 indexing

```
pcr_ip_2D.indexing
```

3.24.2.16 Ip

```
pcr_ip_2D.Ip
```

3.24.2.17 label

```
pcr_ip_2D.label
```

3.24.2.18 ncols

```
pcr_ip_2D.ncols
```

3.24.2.19 out_id

```
def pcr_ip_2D.out_id = getTimeID(time_test, delta_t, t_ini)
```

3.24.2.20 Pcr

```
pcr_ip_2D.Pcr
```

3.24.2.21 sharey

```
pcr_ip_2D.sharey
```

3.24.2.22 sparse

```
pcr_ip_2D.sparse
```

3.24.2.23 t_ini

```
int pcr_ip_2D.t_ini = 0.*cst.kyr
```

3.24.2.24 t_max

```
int pcr_ip_2D.t_max = 200.*cst.kyr
```

3.24.2.25 time_test

```
float pcr_ip_2D.time_test = 5.9*cst.kyr
```

3.24.2.26 X

```
pcr_ip_2D.X
```

3.24.2.27 x_center

```
int pcr_ip_2D.x_center = 1000.
```

3.24.2.28 XV

```
pcr_ip_2D.XV
```

3.24.2.29 XV_log

```
pcr_ip_2D.XV_log = XV/cst.pc
```

3.25 PDE_solvers Namespace Reference

Functions

- def TDMA (a, b, c, d)
- def A (x)
- def B (x)
- def C (x)
- def Q (x)
- def T (x)
- def finiteDiffSolver (dt, Tmax, u)
- def SimpleImplicitSolver (dt, Tmax, u)
- def CC70Solver (dt, Tmax, u)

Variables

- float pc = 3.086e18

  Tri Diagonal Matrix Algorithm(a.k.a Thomas algorithm) solver def TDMAsolver(a, b, c, d): ''' TDMA solver, a b c d can be NumPy array type or Python list type.
- float yr = 365.25∗86400
- int kyr = 1e3∗yr
- int M = 2048
- int Xmin = 0.
- int Xmax = 1000.∗pc
- X = np.linspace(Xmin, Xmax, M+1)
- u = np.zeros(M+1)

  plt.semilogy(X/pc, u, c="blue") plt.plot(X/pc, u/U, c="red") plt.axhline(1.) print ("ratio = ",sum(u)/sum(U))
- u0 = u[1]
- uM = u[M-1]
- u_ini = u.copy()
- u_end = u
- int Tmax = 10.∗kyr
- def u_0 = CC70Solver(0.1∗kyr, Tmax, u)
- def u_1 = CC70Solver(0.5∗kyr, Tmax, u)
- def u_2 = CC70Solver(5.∗kyr, Tmax, u)
- figsize
- c

3.25.1 Function Documentation

3.25.1.1 A()

```
def PDE_solvers.A (
              x )
```

3.25.1.2 B()

```
def PDE_solvers.B (
              x )
```

3.25.1.3 C()

```
def PDE_solvers.C (
              x )
```

3.25.1.4 CC70Solver()

```
def PDE_solvers.CC70Solver (
              dt,
              Tmax,
              u )
```

3.25.1.5 finiteDiffSolver()

```
def PDE_solvers.finiteDiffSolver (
              dt,
              Tmax,
              u )
```

3.25.1.6 Q()

```
def PDE_solvers.Q (
              x )
```

3.25.1.7 SimpleImplicitSolver()

```
def PDE_solvers.SimpleImplicitSolver (
              dt,
              Tmax,
              u )
```

3.25.1.8 T()

```
def PDE_solvers.T (
              x )
```

3.25.1.9 TDMA()

```
def PDE_solvers.TDMA (
              a,
              b,
              c,
              d )
```

3.25.2 Variable Documentation

3.25.2.1 c

```
PDE_solvers.c
```

3.25.2.2 figsize

```
PDE_solvers.figsize
```

3.25.2.3 kyr

```
int PDE_solvers.kyr = 1e3*yr
```

3.25.2.4 M

```
int PDE_solvers.M = 2048
```

3.25.2.5 pc

```
float PDE_solvers.pc = 3.086e18
```

Tri Diagonal Matrix Algorithm(a.k.a Thomas algorithm) solver def TDMAsolver(a, b, c, d): ''' TDMA solver, a b c d can be NumPy array type or Python list type.

refer to http://en.wikipedia.org/wiki/Tridiagonal_matrix_algorithm and to http://www.cfd-online.com/Wiki/Tridiagonal_matrix_algorithm_-_TDMA_(Thomas_algorithm) ''' nf = len(d) # number of equations ac, bc, cc, dc = map(np.array, (a, b, c, d)) # copy arrays for it in range(1, nf): mc = ac[it-1]/bc[it-1] bc[it] = bc[it] - mc*cc[it-1] dc[it] = dc[it] - mc*dc[it-1]

xc = bc xc[-1] = dc[-1]/bc[-1]

for il in range(nf-2, -1, -1): xc[il] = (dc[il]-cc[il]*xc[il+1])/bc[il]

return xc

3.25.2.6 Tmax

```
int PDE_solvers.Tmax = 10.*kyr
```

3.25.2.7 u

```
PDE_solvers.u = np.zeros(M+1)
```

plt.semilogy(X/pc, u, c="blue") plt.plot(X/pc, u/U, c="red") plt.axhline(1.) print ("ratio = ",sum(u)/sum(U))

3.25.2.8 u0

```
PDE_solvers.u0 = u[1]
```

3.25.2.9 u_0

```
PDE_solvers.u_0 = CC70Solver(0.1*kyr, Tmax, u)
```

3.25.2.10 u_1

```
PDE_solvers.u_1 = CC70Solver(0.5*kyr, Tmax, u)
```

3.25.2.11 u_2

```
PDE_solvers.u_2 = CC70Solver(5.*kyr, Tmax, u)
```

3.25.2.12 u_end

```
PDE_solvers.u_end = u
```

3.25.2.13 u_ini

```
PDE_solvers.u_ini = u.copy()
```

3.25.2.14 uM

```
PDE_solvers.uM = u[M-1]
```

3.25.2.15 X

```
PDE_solvers.X = np.linspace(Xmin, Xmax, M+1)
```

3.25.2.16 Xmax

```
int PDE_solvers.Xmax = 1000.*pc
```

3.25.2.17 Xmin

```
int PDE_solvers.Xmin = 0.
```

3.25.2.18 yr

```
float PDE_solvers.yr = 365.25*86400
```

3.26 phases_collection Namespace Reference

Functions

- def ism_phase (Temp, Bfiel, nion, ntot, mion, mneutral)

Variables

- def HII = ism_phase(8000, 10.e-6, 99.9, 100., 0.93∗cst.mHII+0.07∗cst.mHeII, 0.93∗cst.mHI+0.07∗cst.mHeI)
- def WIM = ism_phase(8000, 5.00001e-6, 0.315, 0.35, cst.mHII, 0.93∗cst.mHI+0.07∗cst.mHeI)
- def WNM = ism_phase(8000, 5.00001e-6, 7e-3, 0.35, cst.mHII, 0.93∗cst.mHI+0.07∗cst.mHeI)
- def CNM = ism_phase(50, 6.00001e-6, 2.3e-2, 30.0, cst.mCII, 0.93∗cst.mHI+0.07∗cst.mHeI)
- def DiM = ism_phase(50, 6.00001e-6, 3.0e-2, 300, cst.mCII, 0.93∗(0.5∗cst.mHI + 0.5∗cst.mH2) + 0.07∗cst.↩ mHeI)
- def DeM = ism_phase(30, 26.0001e-6, 3.0e-2, 3000, cst.mHCOII, 0.93∗cst.mH2 + 0.07∗cst.mHeI)
- def DeC = ism_phase(20, 59.0001e-6, 1.0e-2, 1e4, cst.mHCOII, 0.93∗cst.mH2 + 0.07∗cst.mHeI)

3.26.1 Function Documentation

3.26.1.1 ism_phase()

```
def phases_collection.ism_phase (
              Temp,
              Bfiel,
              nion,
              ntot,
              mion,
              mneutral )
```

3.26.2 Variable Documentation

3.26.2.1 CNM

```
def phases_collection.CNM = ism_phase( 50, 6.00001e-6, 2.3e-2, 30.0, cst.mCII, 0.93*cst.mH↩
I+0.07*cst.mHeI)
```

3.26.2.2 DeC

```
def phases_collection.DeC = ism_phase( 20, 59.0001e-6, 1.0e-2, 1e4, cst.mHCOII, 0.93*cst.mH2 +
0.07*cst.mHeI)
```

3.26.2.3 DeM

```
def phases_collection.DeM = ism_phase( 30, 26.0001e-6, 3.0e-2, 3000, cst.mHCOII, 0.93*cst.mH2
+ 0.07*cst.mHeI)
```

3.26.2.4 DiM

```
def phases_collection.DiM = ism_phase( 50, 6.00001e-6, 3.0e-2, 300, cst.mCII, 0.93*(0.5*cst.m↩
HI + 0.5*cst.mH2) + 0.07*cst.mHeI)
```

3.26.2.5 HII

```
def phases_collection.HII = ism_phase(8000, 10.e-6, 99.9, 100., 0.93*cst.mHII+0.07*cst.mHeII,
0.93*cst.mHI+0.07*cst.mHeI)
```

3.26.2.6 WIM

```
def phases_collection.WIM = ism_phase(8000, 5.00001e-6, 0.315, 0.35, cst.mHII, 0.93*cst.mH↩
I+0.07*cst.mHeI)
```

3.26.2.7 WNM

```
def phases_collection.WNM = ism_phase(8000, 5.00001e-6, 7e-3, 0.35, cst.mHII, 0.93*cst.mHI+0.↩
07*cst.mHeI)
```

3.27 physical_models Namespace Reference

Functions

- def collision_rate (specie1, specie2, phase)
- def cr_escape_time_model (option, model, Ecr, props)
- def cr_escape_radius_model (option, model, time, props)

3.27.1 Function Documentation

3.27.1.1 collision_rate()

```
def physical_models.collision_rate (
              specie1,
              specie2,
              phase )
```

3.27.1.2 cr_escape_radius_model()

```
def physical_models.cr_escape_radius_model (
              option,
              model,
              time,
              props )
```

3.27.1.3 cr_escape_time_model()

```
def physical_models.cr_escape_time_model (
              option,
              model,
              Ecr,
              props )
```

3.28 setup Namespace Reference

Variables

- X = nml.X
- E = nml.E
- nx = nml.NX

  END : INITIAL ISM CONDITIONS #.
- ne = nml.NE
- x_center = nml.box_center
- x_center_index = int(x_center/(X[1] - X[0]))
- ism_values = nml.ism_values
- B = ism_values.get("B")
- nn = ism_values.get("nn")
- ni = ism_values.get("ni")
- mn = ism_values.get("mn")
- mi = ism_values.get("mi")
- T = ism_values.get("T")
- Xi = ism_values.get("X")
- va = ism_values.get("VA")
- g_in = ism_values.get("gamma_in")
- g_lz = ism_values.get("gamma_lz")
- d00 = np.zeros(len(X))

INITIAL ISM CONDITIONS #.

- D = np.zeros((len(E), len(X)))
- Db = np.zeros((len(E), len(X)))
- Ip = np.zeros((len(E), len(X)))
- Im = np.zeros((len(E), len(X)))
- VA = np.zeros((len(E), len(X)))
- gamma_in = np.zeros((len(E), len(X)))
- gamma_lazarian = np.zeros((len(E), len(X)))
- gamma_nlld = np.zeros((len(E), len(X)))
- gamma_tot = np.zeros((len(E), len(X)))
- Pcr = np.zeros((len(E), len(X)))
- Pe = np.zeros((len(E), len(X)))
- dictionary medium_props
- mass
- kmin
- q
- I
- in_damping = dp.indamping_alfven(xi , E[e], ism_values)
- variable
- path
- dictionary variables
- ext

3.28.1 Variable Documentation

3.28.1.1 B

```
setup.B = ism_values.get("B")
```

3.28.1.2 D

```
setup.D = np.zeros((len(E), len(X)))
```

3.28.1.3 d00

```
setup.d00 = np.zeros(len(X))
```

INITIAL ISM CONDITIONS #.

You can modify this part #

3.28.1.4 Db

```
setup.Db = np.zeros((len(E), len(X)))
```

3.28.1.5 E

```
setup.E = nml.E
```

3.28.1.6 ext

```
setup.ext
```

3.28.1.7 g_in

```
setup.g_in = ism_values.get("gamma_in")
```

3.28.1.8 g_lz

```
setup.g_lz = ism_values.get("gamma_lz")
```

3.28.1.9 gamma_in

```
setup.gamma_in = np.zeros((len(E), len(X)))
```

3.28.1.10 gamma_lazarian

```
setup.gamma_lazarian = np.zeros((len(E), len(X)))
```

3.28.1.11 gamma_nlld

```
setup.gamma_nlld = np.zeros((len(E), len(X)))
```

3.28.1.12 gamma_tot

```
setup.gamma_tot = np.zeros((len(E), len(X)))
```

3.28.1.13 I

```
setup.I
```

3.28.1.14 Im

```
setup.Im = np.zeros((len(E), len(X)))
```

3.28.1.15 in_damping

```
setup.in_damping = dp.indamping_alfven(xi , E[e], ism_values)
```

3.28.1.16 Ip

```
setup.Ip = np.zeros((len(E), len(X)))
```

3.28.1.17 ism_values

```
setup.ism_values = nml.ism_values
```

3.28.1.18 kmin

```
setup.kmin
```

3.28.1.19 mass

```
setup.mass
```

3.28.1.20 medium_props

dictionary setup.medium_props

Initial value:

```
1 =  {"B"  : B[xi],
2                              "mn" : mn[xi],
3                              "nn" : nn[xi],
4                              "mi" : mi[xi],
5                              "ni" : ni[xi],
6                              "X"  : Xi[xi],
7                              "T"  : T[xi]}
```

3.28.1.21 mi

setup.mi = ism_values.get("mi")

3.28.1.22 mn

setup.mn = ism_values.get("mn")

3.28.1.23 ne

setup.ne = nml.NE

3.28.1.24 ni

setup.ni = ism_values.get("ni")

3.28.1.25 nn

setup.nn = ism_values.get("nn")

3.28.1.26 nx

```
setup.nx = nml.NX
```

END : INITIAL ISM CONDITIONS #.

WRITE THE INITAL CONDITIONS #

3.28.1.27 path

```
setup.path
```

3.28.1.28 Pcr

```
setup.Pcr = np.zeros((len(E), len(X)))
```

3.28.1.29 Pe

```
setup.Pe = np.zeros((len(E), len(X)))
```

3.28.1.30 q

```
setup.q
```

3.28.1.31 T

```
setup.T = ism_values.get("T")
```

3.28.1.32 va

```
setup.va = ism_values.get("VA")
```

3.28.1.33 VA

```
setup.VA = np.zeros((len(E), len(X)))
```

3.28.1.34 variable

```
setup.variable
```

3.28.1.35 variables

```
setup.variables
```

Initial value:

```
1 =  {"NX"       : nx,
2               "NE"       : ne,
3               "ni"       : ni[x_center_index],
4               "X"        : Xi[x_center_index],
5               "mn"       : mn[x_center_index],
6               "T"        : T[x_center_index],
7               "center"   :x_center,
8               "center_index":x_center_index,
9               "B"        : B[x_center_index]}
```

3.28.1.36 X

```
setup.X = nml.X
```

3.28.1.37 x_center

```
setup.x_center = nml.box_center
```

3.28.1.38 x_center_index

```
setup.x_center_index = int(x_center/(X[1] - X[0]))
```

3.28.1.39 Xi

```
setup.Xi = ism_values.get("X")
```

3.29 setup_adv Namespace Reference

Functions

- def door (X, X1, X2, V)

Variables

- X = nml.X
- E = nml.E
- nx = nml.NX

  END : INITIAL ISM CONDITIONS #.
- ne = nml.NE
- x_center = nml.box_center
- x_center_index = int(x_center/(X[1] - X[0]))
- ism_values = nml.ism_values
- B = ism_values.get("B")
- nn = ism_values.get("nn")
- ni = ism_values.get("ni")
- mn = ism_values.get("mn")
- mi = ism_values.get("mi")
- T = ism_values.get("T")
- Xi = ism_values.get("X")
- va = ism_values.get("VA")
- d00 = np.zeros(len(X))

  INITIAL ISM CONDITIONS #.
- D = np.zeros((len(E), len(X)))
- Db = np.zeros((len(E), len(X)))
- lp = np.zeros((len(E), len(X)))
- lm = np.zeros((len(E), len(X)))
- VA = np.zeros((len(E), len(X)))
- gamma_in = np.zeros((len(E), len(X)))
- gamma_lazarian = np.zeros((len(E), len(X)))
- gamma_nlld = np.zeros((len(E), len(X)))
- gamma_tot = np.zeros((len(E), len(X)))
- Pcr = np.zeros((len(E), len(X)))
- Pe = np.zeros((len(E), len(X)))
- variable
- path
- dictionary variables
- ext

3.29.1 Function Documentation

3.29.1.1 door()

```
def setup_adv.door (
              X,
              X1,
              X2,
              V )
```

3.29.2 Variable Documentation

3.29.2.1 B

```
setup_adv.B = ism_values.get("B")
```

3.29.2.2 D

```
setup_adv.D = np.zeros((len(E), len(X)))
```

3.29.2.3 d00

```
setup_adv.d00 = np.zeros(len(X))
```

INITIAL ISM CONDITIONS #.

You can modify this part #

3.29.2.4 Db

```
setup_adv.Db = np.zeros((len(E), len(X)))
```

3.29.2.5 E

```
setup_adv.E = nml.E
```

3.29.2.6 ext

```
setup_adv.ext
```

3.29.2.7 gamma_in

```
setup_adv.gamma_in = np.zeros((len(E), len(X)))
```

3.29.2.8 gamma_lazarian

```
setup_adv.gamma_lazarian = np.zeros((len(E), len(X)))
```

3.29.2.9 gamma_nlld

```
setup_adv.gamma_nlld = np.zeros((len(E), len(X)))
```

3.29.2.10 gamma_tot

```
setup_adv.gamma_tot = np.zeros((len(E), len(X)))
```

3.29.2.11 Im

```
setup_adv.Im = np.zeros((len(E), len(X)))
```

3.29.2.12 Ip

```
setup_adv.Ip = np.zeros((len(E), len(X)))
```

3.29.2.13 ism_values

```
setup_adv.ism_values = nml.ism_values
```

3.29.2.14 mi

```
setup_adv.mi = ism_values.get("mi")
```

3.29.2.15 mn

```
setup_adv.mn = ism_values.get("mn")
```

3.29.2.16 ne

```
setup_adv.ne = nml.NE
```

3.29.2.17 ni

```
setup_adv.ni = ism_values.get("ni")
```

3.29.2.18 nn

```
setup_adv.nn = ism_values.get("nn")
```

3.29.2.19 nx

```
setup_adv.nx = nml.NX
```

END : INITIAL ISM CONDITIONS #.

WRITE THE INITAL CONDITIONS #

3.29.2.20 path

```
setup_adv.path
```

3.29.2.21 Pcr

```
setup_adv.Pcr = np.zeros((len(E), len(X)))
```

3.29.2.22 Pe

```
setup_adv.Pe = np.zeros((len(E), len(X)))
```

3.29.2.23 T

```
setup_adv.T = ism_values.get("T")
```

3.29.2.24 va

```
setup_adv.va = ism_values.get("VA")
```

3.29.2.25 VA

```
setup_adv.VA = np.zeros((len(E), len(X)))
```

3.29.2.26 variable

```
setup_adv.variable
```

3.29.2.27 variables

```
setup_adv.variables
```

Initial value:

```
1 =  {"NX"       : nx,
2               "NE"       : ne,
3               "ni"       : ni[x_center_index],
4               "X"        : Xi[x_center_index],
5               "mn"       : mn[x_center_index],
6               "T"        : T[x_center_index],
7               "center"   :x_center,
8               "center_index":x_center_index,
9               "B"        : B[x_center_index]}
```

3.29.2.28 X

```
setup_adv.X = nml.X
```

3.29.2.29 x_center

```
setup_adv.x_center = nml.box_center
```

3.29.2.30 x_center_index

```
setup_adv.x_center_index = int(x_center/(X[1] - X[0]))
```

3.29.2.31 Xi

```
setup_adv.Xi = ism_values.get("X")
```

3.30 setup_adve Namespace Reference

Functions

- def door (X, X1, X2, V)
- def spec (E, q)

Variables

- X = nml.X
- E = nml.E
- nx = nml.NX

  END : INITIAL ISM CONDITIONS #.
- ne = nml.NE
- x_center = nml.box_center
- x_center_index = int(x_center/(X[1] - X[0]))
- ism_values = nml.ism_values
- B = ism_values.get("B")
- nn = ism_values.get("nn")
- ni = ism_values.get("ni")
- mn = ism_values.get("mn")
- mi = ism_values.get("mi")
- T = ism_values.get("T")
- Xi = ism_values.get("X")
- va = ism_values.get("VA")

- d00 = np.zeros(len(X))

  INITIAL ISM CONDITIONS #.
- D = np.zeros((len(E), len(X)))
- Db = np.zeros((len(E), len(X)))
- Ip = np.zeros((len(E), len(X)))
- Im = np.zeros((len(E), len(X)))
- VA = np.zeros((len(E), len(X)))
- gamma_in = np.zeros((len(E), len(X)))
- gamma_lazarian = np.zeros((len(E), len(X)))
- gamma_nlld = np.zeros((len(E), len(X)))
- gamma_tot = np.zeros((len(E), len(X)))
- Pcr = np.zeros((len(E), len(X)))
- Pe = np.zeros((len(E), len(X)))
- variable
- path
- dictionary variables
- ext

3.30.1 Function Documentation

3.30.1.1 door()

```
def setup_adve.door (
              X,
              X1,
              X2,
              V )
```

3.30.1.2 spec()

```
def setup_adve.spec (
              E,
              q )
```

3.30.2 Variable Documentation

3.30.2.1 B

```
setup_adve.B = ism_values.get("B")
```

3.30.2.2 D

```
setup_adve.D = np.zeros((len(E), len(X)))
```

3.30.2.3 d00

```
setup_adve.d00 = np.zeros(len(X))
```

INITIAL ISM CONDITIONS #.

You can modify this part #

3.30.2.4 Db

```
setup_adve.Db = np.zeros((len(E), len(X)))
```

3.30.2.5 E

```
setup_adve.E = nml.E
```

3.30.2.6 ext

```
setup_adve.ext
```

3.30.2.7 gamma_in

```
setup_adve.gamma_in = np.zeros((len(E), len(X)))
```

3.30.2.8 gamma_lazarian

```
setup_adve.gamma_lazarian = np.zeros((len(E), len(X)))
```

3.30.2.9 gamma_nlld

```
setup_adve.gamma_nlld = np.zeros((len(E), len(X)))
```

3.30.2.10 gamma_tot

```
setup_adve.gamma_tot = np.zeros((len(E), len(X)))
```

3.30.2.11 Im

```
setup_adve.Im = np.zeros((len(E), len(X)))
```

3.30.2.12 Ip

```
setup_adve.Ip = np.zeros((len(E), len(X)))
```

3.30.2.13 ism_values

```
setup_adve.ism_values = nml.ism_values
```

3.30.2.14 mi

```
setup_adve.mi = ism_values.get("mi")
```

3.30.2.15 mn

```
setup_adve.mn = ism_values.get("mn")
```

3.30.2.16 ne

```
setup_adve.ne = nml.NE
```

3.30.2.17 ni

```
setup_adve.ni = ism_values.get("ni")
```

3.30.2.18 nn

```
setup_adve.nn = ism_values.get("nn")
```

3.30.2.19 nx

```
setup_adve.nx = nml.NX
```

END : INITIAL ISM CONDITIONS #.

WRITE THE INITAL CONDITIONS #

3.30.2.20 path

```
setup_adve.path
```

3.30.2.21 Pcr

```
setup_adve.Pcr = np.zeros((len(E), len(X)))
```

3.30.2.22 Pe

```
setup_adve.Pe = np.zeros((len(E), len(X)))
```

3.30.2.23 T

```
setup_adve.T = ism_values.get("T")
```

3.30.2.24 va

```
setup_adve.va = ism_values.get("VA")
```

3.30.2.25 VA

```
setup_adve.VA = np.zeros((len(E), len(X)))
```

3.30.2.26 variable

```
setup_adve.variable
```

3.30.2.27 variables

```
setup_adve.variables
```

Initial value:

```
1 =  {"NX"       : nx,
2               "NE"       : ne,
3               "ni"       : ni[x_center_index],
4               "X"        : Xi[x_center_index],
5               "mn"       : mn[x_center_index],
6               "T"        : T[x_center_index],
7               "center"   :x_center,
8               "center_index":x_center_index,
9               "B"        : B[x_center_index]}
```

3.30.2.28 X

```
setup_adve.X = nml.X
```

3.30.2.29 x_center

```
setup_adve.x_center = nml.box_center
```

3.30.2.30 x_center_index

```
setup_adve.x_center_index = int(x_center/(X[1] - X[0]))
```

3.30.2.31 Xi

```
setup_adve.Xi = ism_values.get("X")
```

3.31 setup_advst Namespace Reference

Functions

- def door (X, X1, X2, V)
- def spec (E, q)

Variables

- X = nml.X
- E = nml.E
- nx = nml.NX

  END : INITIAL ISM CONDITIONS #.
- ne = nml.NE
- x_center = nml.box_center
- x_center_index = int(x_center/(X[1] - X[0]))
- ism_values = nml.ism_values
- B = ism_values.get("B")
- nn = ism_values.get("nn")
- ni = ism_values.get("ni")
- mn = ism_values.get("mn")
- mi = ism_values.get("mi")
- T = ism_values.get("T")
- Xi = ism_values.get("X")
- va = ism_values.get("VA")
- d00 = np.zeros(len(X))

  INITIAL ISM CONDITIONS #.
- D = np.zeros((len(E), len(X)))
- Db = np.zeros((len(E), len(X)))
- Ip = np.zeros((len(E), len(X)))
- Im = np.zeros((len(E), len(X)))
- VA = np.zeros((len(E), len(X)))
- gamma_in = np.zeros((len(E), len(X)))
- gamma_lazarian = np.zeros((len(E), len(X)))
- gamma_nlld = np.zeros((len(E), len(X)))
- gamma_tot = np.zeros((len(E), len(X)))
- Pcr = np.zeros((len(E), len(X)))
- Pe = np.zeros((len(E), len(X)))
- variable
- path
- dictionary variables
- ext

3.31.1 Function Documentation

3.31.1.1 door()

```
def setup_advst.door (
              X,
              X1,
              X2,
              V )
```

3.31.1.2 spec()

```
def setup_advst.spec (
              E,
              q )
```

3.31.2 Variable Documentation

3.31.2.1 B

```
setup_advst.B = ism_values.get("B")
```

3.31.2.2 D

```
setup_advst.D = np.zeros((len(E), len(X)))
```

3.31.2.3 d00

```
setup_advst.d00 = np.zeros(len(X))
```

INITIAL ISM CONDITIONS #.

You can modify this part #

3.31.2.4 Db

```
setup_advst.Db = np.zeros((len(E), len(X)))
```

3.31.2.5 E

```
setup_advst.E = nml.E
```

3.31.2.6 ext

```
setup_advst.ext
```

3.31.2.7 gamma_in

```
setup_advst.gamma_in = np.zeros((len(E), len(X)))
```

3.31.2.8 gamma_lazarian

```
setup_advst.gamma_lazarian = np.zeros((len(E), len(X)))
```

3.31.2.9 gamma_nlld

```
setup_advst.gamma_nlld = np.zeros((len(E), len(X)))
```

3.31.2.10 gamma_tot

```
setup_advst.gamma_tot = np.zeros((len(E), len(X)))
```

3.31.2.11 Im

```
setup_advst.Im = np.zeros((len(E), len(X)))
```

3.31.2.12 Ip

```
setup_advst.Ip = np.zeros((len(E), len(X)))
```

3.31.2.13 ism_values

```
setup_advst.ism_values = nml.ism_values
```

3.31.2.14 mi

```
setup_advst.mi = ism_values.get("mi")
```

3.31.2.15 mn

```
setup_advst.mn = ism_values.get("mn")
```

3.31.2.16 ne

```
setup_advst.ne = nml.NE
```

3.31.2.17 ni

```
setup_advst.ni = ism_values.get("ni")
```

3.31.2.18 nn

```
setup_advst.nn = ism_values.get("nn")
```

3.31.2.19 nx

```
setup_advst.nx = nml.NX
```

END : INITIAL ISM CONDITIONS #.

WRITE THE INITAL CONDITIONS #

3.31.2.20 path

```
setup_advst.path
```

3.31.2.21 Pcr

```
setup_advst.Pcr = np.zeros((len(E), len(X)))
```

3.31.2.22 Pe

```
setup_advst.Pe = np.zeros((len(E), len(X)))
```

3.31.2.23 T

```
setup_advst.T = ism_values.get("T")
```

3.31.2.24 va

```
setup_advst.va = ism_values.get("VA")
```

3.31.2.25 VA

```
setup_advst.VA = np.zeros((len(E), len(X)))
```

3.31.2.26 variable

```
setup_advst.variable
```

3.31.2.27 variables

```
setup_advst.variables
```

Initial value:

```
1 =  {"NX"       : nx,
2               "NE"       : ne,
3               "ni"       : ni[x_center_index],
4               "X"        : Xi[x_center_index],
5               "mn"       : mn[x_center_index],
6               "T"        : T[x_center_index],
7               "center"   :x_center,
8               "center_index":x_center_index,
9               "B"        : B[x_center_index]}
```

3.31.2.28 X

```
setup_advst.X = nml.X
```

3.31.2.29 x_center

```
setup_advst.x_center = nml.box_center
```

3.31.2.30 x_center_index

```
setup_advst.x_center_index = int(x_center/(X[1] - X[0]))
```

3.31.2.31 Xi

```
setup_advst.Xi = ism_values.get("X")
```

3.32 setup_diff Namespace Reference

Functions

- def door (X, X1, X2, V)

Variables

- X = nml.X
- E = nml.E
- nx = nml.NX

  END : INITIAL ISM CONDITIONS #.
- ne = nml.NE
- x_center = nml.box_center
- x_center_index = int(x_center/(X[1] - X[0]))
- ism_values = nml.ism_values
- B = ism_values.get("B")
- nn = ism_values.get("nn")
- ni = ism_values.get("ni")
- mn = ism_values.get("mn")
- mi = ism_values.get("mi")
- T = ism_values.get("T")
- Xi = ism_values.get("X")
- va = ism_values.get("VA")
- d00 = np.zeros(len(X))

  INITIAL ISM CONDITIONS #.
- D = np.zeros((len(E), len(X)))
- Db = np.zeros((len(E), len(X)))
- Ip = np.zeros((len(E), len(X)))
- Im = np.zeros((len(E), len(X)))
- VA = np.zeros((len(E), len(X)))
- gamma_in = np.zeros((len(E), len(X)))
- gamma_lazarian = np.zeros((len(E), len(X)))
- gamma_nlld = np.zeros((len(E), len(X)))
- gamma_tot = np.zeros((len(E), len(X)))
- Pcr = np.zeros((len(E), len(X)))
- Pe = np.zeros((len(E), len(X)))
- variable
- path
- dictionary variables
- ext

3.32.1 Function Documentation

3.32.1.1 door()

```
def setup_diff.door (
              X,
              X1,
              X2,
              V )
```

3.32.2 Variable Documentation

3.32.2.1 B

```
setup_diff.B = ism_values.get("B")
```

3.32.2.2 D

```
setup_diff.D = np.zeros((len(E), len(X)))
```

3.32.2.3 d00

```
setup_diff.d00 = np.zeros(len(X))
```

INITIAL ISM CONDITIONS #.

You can modify this part #

3.32.2.4 Db

```
setup_diff.Db = np.zeros((len(E), len(X)))
```

3.32.2.5 E

```
setup_diff.E = nml.E
```

3.32.2.6 ext

```
setup_diff.ext
```

3.32.2.7 gamma_in

```
setup_diff.gamma_in = np.zeros((len(E), len(X)))
```

3.32.2.8 gamma_lazarian

```
setup_diff.gamma_lazarian = np.zeros((len(E), len(X)))
```

3.32.2.9 gamma_nlld

```
setup_diff.gamma_nlld = np.zeros((len(E), len(X)))
```

3.32.2.10 gamma_tot

```
setup_diff.gamma_tot = np.zeros((len(E), len(X)))
```

3.32.2.11 Im

```
setup_diff.Im = np.zeros((len(E), len(X)))
```

3.32.2.12 Ip

```
setup_diff.Ip = np.zeros((len(E), len(X)))
```

3.32.2.13 ism_values

```
setup_diff.ism_values = nml.ism_values
```

3.32.2.14 mi

```
setup_diff.mi = ism_values.get("mi")
```

3.32.2.15 mn

```
setup_diff.mn = ism_values.get("mn")
```

3.32.2.16 ne

```
setup_diff.ne = nml.NE
```

3.32.2.17 ni

```
setup_diff.ni = ism_values.get("ni")
```

3.32.2.18 nn

```
setup_diff.nn = ism_values.get("nn")
```

3.32.2.19 nx

```
setup_diff.nx = nml.NX
```

END : INITIAL ISM CONDITIONS #.

WRITE THE INITAL CONDITIONS #

3.32.2.20 path

```
setup_diff.path
```

3.32.2.21 Pcr

```
setup_diff.Pcr = np.zeros((len(E), len(X)))
```

3.32.2.22 Pe

```
setup_diff.Pe = np.zeros((len(E), len(X)))
```

3.32.2.23 T

```
setup_diff.T = ism_values.get("T")
```

3.32.2.24 va

```
setup_diff.va = ism_values.get("VA")
```

3.32.2.25 VA

```
setup_diff.VA = np.zeros((len(E), len(X)))
```

3.32.2.26 variable

```
setup_diff.variable
```

3.32.2.27 variables

```
setup_diff.variables
```

Initial value:

```
1 =  {"NX"       : nx,
2               "NE"       : ne,
3               "ni"       : ni[x_center_index],
4               "X"        : Xi[x_center_index],
5               "mn"       : mn[x_center_index],
6               "T"        : T[x_center_index],
7               "center"   :x_center,
8               "center_index":x_center_index,
9               "B"        : B[x_center_index]}
```

3.32.2.28 X

```
setup_diff.X = nml.X
```

3.32.2.29 x_center

```
setup_diff.x_center = nml.box_center
```

3.32.2.30 x_center_index

```
setup_diff.x_center_index = int(x_center/(X[1] - X[0]))
```

3.32.2.31 Xi

```
setup_diff.Xi = ism_values.get("X")
```

3.33 setup_uniform Namespace Reference

Variables

- X = nml.X
- E = nml.E
- nx = nml.NX

  END : INITIAL ISM CONDITIONS #.
- ne = nml.NE
- x_center = nml.box_center
- x_center_index = int(x_center/(X[1] - X[0]))
- ism_values = nml.ism_values
- B = ism_values.get("B")
- nn = ism_values.get("nn")
- ni = ism_values.get("ni")
- mn = ism_values.get("mn")
- mi = ism_values.get("mi")
- T = ism_values.get("T")
- Xi = ism_values.get("X")
- va = ism_values.get("VA")
- g_in = ism_values.get("gamma_in")
- g_lz = ism_values.get("gamma_lz")
- d00 = np.zeros(len(X))

  INITIAL ISM CONDITIONS #.
- D = np.zeros((len(E), len(X)))
- Db = np.zeros((len(E), len(X)))
- Ip = np.zeros((len(E), len(X)))
- Im = np.zeros((len(E), len(X)))
- VA = np.zeros((len(E), len(X)))
- gamma_in = np.zeros((len(E), len(X)))
- gamma_lazarian = np.zeros((len(E), len(X)))
- gamma_nlld = np.zeros((len(E), len(X)))
- gamma_tot = np.zeros((len(E), len(X)))

- Pcr = np.zeros((len(E), len(X)))
- Pe = np.zeros((len(E), len(X)))
- dictionary medium_props
- mass
- kmin
- q
- l
- in_damping = dp.indamping_alfven(xi , E[e], ism_values)
- variable
- path
- dictionary variables
- ext

3.33.1 Variable Documentation

3.33.1.1 B

```
setup_uniform.B = ism_values.get("B")
```

3.33.1.2 D

```
setup_uniform.D = np.zeros((len(E), len(X)))
```

3.33.1.3 d00

```
setup_uniform.d00 = np.zeros(len(X))
```

INITIAL ISM CONDITIONS #.

You can modify this part #

3.33.1.4 Db

```
setup_uniform.Db = np.zeros((len(E), len(X)))
```

3.33.1.5 E

```
setup_uniform.E = nml.E
```

3.33.1.6 ext

```
setup_uniform.ext
```

3.33.1.7 g_in

```
setup_uniform.g_in = ism_values.get("gamma_in")
```

3.33.1.8 g_lz

```
setup_uniform.g_lz = ism_values.get("gamma_lz")
```

3.33.1.9 gamma_in

```
setup_uniform.gamma_in = np.zeros((len(E), len(X)))
```

3.33.1.10 gamma_lazarian

```
setup_uniform.gamma_lazarian = np.zeros((len(E), len(X)))
```

3.33.1.11 gamma_nlld

```
setup_uniform.gamma_nlld = np.zeros((len(E), len(X)))
```

3.33.1.12 gamma_tot

```
setup_uniform.gamma_tot = np.zeros((len(E), len(X)))
```

3.33.1.13 I

```
setup_uniform.I
```

3.33.1.14 Im

```
setup_uniform.Im = np.zeros((len(E), len(X)))
```

3.33.1.15 in_damping

```
setup_uniform.in_damping = dp.indamping_alfven(xi , E[e], ism_values)
```

3.33.1.16 Ip

```
setup_uniform.Ip = np.zeros((len(E), len(X)))
```

3.33.1.17 ism_values

```
setup_uniform.ism_values = nml.ism_values
```

3.33.1.18 kmin

```
setup_uniform.kmin
```

3.33.1.19 mass

```
setup_uniform.mass
```

3.33.1.20 medium_props

```
dictionary setup_uniform.medium_props
```

Initial value:

```
1 =  {"B"  : B[xi],
2                              "mn" : mn[xi],
3                              "nn" : nn[xi],
4                              "mi" : mi[xi],
5                              "ni" : ni[xi],
6                              "X"  : Xi[xi],
7                              "T"  : T[xi]}
```

3.33.1.21 mi

```
setup_uniform.mi = ism_values.get("mi")
```

3.33.1.22 mn

```
setup_uniform.mn = ism_values.get("mn")
```

3.33.1.23 ne

```
setup_uniform.ne = nml.NE
```

3.33.1.24 ni

```
setup_uniform.ni = ism_values.get("ni")
```

3.33.1.25 nn

```
setup_uniform.nn = ism_values.get("nn")
```

3.33.1.26 nx

```
setup_uniform.nx = nml.NX
```

END : INITIAL ISM CONDITIONS #.

WRITE THE INITAL CONDITIONS #

3.33.1.27 path

```
setup_uniform.path
```

3.33.1.28 Pcr

```
setup_uniform.Pcr = np.zeros((len(E), len(X)))
```

3.33.1.29 Pe

```
setup_uniform.Pe = np.zeros((len(E), len(X)))
```

3.33.1.30 q

```
setup_uniform.q
```

3.33.1.31 T

```
setup_uniform.T = ism_values.get("T")
```

3.33.1.32 va

```
setup_uniform.va = ism_values.get("VA")
```

3.33.1.33 VA

```
setup_uniform.VA = np.zeros((len(E), len(X)))
```

3.33.1.34 variable

```
setup_uniform.variable
```

3.33.1.35 variables

```
setup_uniform.variables
```

Initial value:

```
1 =  {"NX"       : nx,
2               "NE"       : ne,
3               "ni"       : ni[x_center_index],
4               "X"        : Xi[x_center_index],
5               "mn"       : mn[x_center_index],
6               "T"        : T[x_center_index],
7               "center"   :x_center,
8               "center_index":x_center_index,
9               "B"        : B[x_center_index]}
```

3.33.1.36 X

```
setup_uniform.X = nml.X
```

3.33.1.37 x_center

```
setup_uniform.x_center = nml.box_center
```

3.33.1.38 x_center_index

```
setup_uniform.x_center_index = int(x_center/(X[1] - X[0]))
```

3.33.1.39 Xi

```
setup_uniform.Xi = ism_values.get("X")
```

3.34 setup_vdiff Namespace Reference

Functions

- def door (X, X1, X2, V)
- def f (X, X1=900.∗cst.pc, X2=1100.∗cst.pc, sig=20.∗cst.pc, R=1e-3)

Variables

- X = nml.X
- E = nml.E
- nx = nml.NX

  END : INITIAL ISM CONDITIONS #.
- ne = nml.NE
- x_center = nml.box_center
- x_center_index = int(x_center/(X[1] - X[0]))
- ism_values = nml.ism_values
- B = ism_values.get("B")
- nn = ism_values.get("nn")
- ni = ism_values.get("ni")
- mn = ism_values.get("mn")
- mi = ism_values.get("mi")
- T = ism_values.get("T")
- Xi = ism_values.get("X")
- va = ism_values.get("VA")
- d00 = np.zeros(len(X))

  INITIAL ISM CONDITIONS #.
- D = np.zeros((len(E), len(X)))
- Db = np.zeros((len(E), len(X)))
- lp = np.zeros((len(E), len(X)))
- lm = np.zeros((len(E), len(X)))
- VA = np.zeros((len(E), len(X)))
- gamma_in = np.zeros((len(E), len(X)))
- gamma_lazarian = np.zeros((len(E), len(X)))
- gamma_nlld = np.zeros((len(E), len(X)))
- gamma_tot = np.zeros((len(E), len(X)))
- Pcr = np.zeros((len(E), len(X)))
- Pe = np.zeros((len(E), len(X)))
- variable
- path
- dictionary variables
- ext

3.34.1 Function Documentation

3.34.1.1 door()

```
def setup_vdiff.door (
              X,
              X1,
              X2,
              V )
```

3.34.1.2 f()

```
def setup_vdiff.f (
              X,
              X1 = 900.*cst.pc,
              X2 = 1100.*cst.pc,
              sig = 20.*cst.pc,
              R = 1e-3 )
```

3.34.2 Variable Documentation

3.34.2.1 B

```
setup_vdiff.B = ism_values.get("B")
```

3.34.2.2 D

```
setup_vdiff.D = np.zeros((len(E), len(X)))
```

3.34.2.3 d00

```
setup_vdiff.d00 = np.zeros(len(X))
```

INITIAL ISM CONDITIONS #.

You can modify this part #

3.34.2.4 Db

```
setup_vdiff.Db = np.zeros((len(E), len(X)))
```

3.34.2.5 E

```
setup_vdiff.E = nml.E
```

3.34.2.6 ext

```
setup_vdiff.ext
```

3.34.2.7 gamma_in

```
setup_vdiff.gamma_in = np.zeros((len(E), len(X)))
```

3.34.2.8 gamma_lazarian

```
setup_vdiff.gamma_lazarian = np.zeros((len(E), len(X)))
```

3.34.2.9 gamma_nlld

```
setup_vdiff.gamma_nlld = np.zeros((len(E), len(X)))
```

3.34.2.10 gamma_tot

```
setup_vdiff.gamma_tot = np.zeros((len(E), len(X)))
```

3.34.2.11 Im

```
setup_vdiff.Im = np.zeros((len(E), len(X)))
```

3.34.2.12 Ip

```
setup_vdiff.Ip = np.zeros((len(E), len(X)))
```

3.34.2.13 ism_values

```
setup_vdiff.ism_values = nml.ism_values
```

3.34.2.14 mi

```
setup_vdiff.mi = ism_values.get("mi")
```

3.34.2.15 mn

```
setup_vdiff.mn = ism_values.get("mn")
```

3.34.2.16 ne

```
setup_vdiff.ne = nml.NE
```

3.34.2.17 ni

```
setup_vdiff.ni = ism_values.get("ni")
```

3.34.2.18 nn

```
setup_vdiff.nn = ism_values.get("nn")
```

3.34.2.19 nx

```
setup_vdiff.nx = nml.NX
```

END : INITIAL ISM CONDITIONS #.

WRITE THE INITAL CONDITIONS #

3.34.2.20 path

```
setup_vdiff.path
```

3.34.2.21 Pcr

```
setup_vdiff.Pcr = np.zeros((len(E), len(X)))
```

3.34.2.22 Pe

```
setup_vdiff.Pe = np.zeros((len(E), len(X)))
```

3.34.2.23 T

```
setup_vdiff.T = ism_values.get("T")
```

3.34.2.24 va

```
setup_vdiff.va = ism_values.get("VA")
```

3.34.2.25 VA

```
setup_vdiff.VA = np.zeros((len(E), len(X)))
```

3.34.2.26 variable

```
setup_vdiff.variable
```

3.34.2.27 variables

```
setup_vdiff.variables
```

Initial value:

```
1 =  {"NX"       : nx,
2               "NE"       : ne,
3               "ni"       : ni[x_center_index],
4               "X"        : Xi[x_center_index],
5               "mn"       : mn[x_center_index],
6               "T"        : T[x_center_index],
7               "center"   :x_center,
8               "center_index":x_center_index,
9               "B"        : B[x_center_index]}
```

3.34.2.28 X

```
setup_vdiff.X = nml.X
```

3.34.2.29 x_center

```
setup_vdiff.x_center = nml.box_center
```

3.34.2.30 x_center_index

```
setup_vdiff.x_center_index = int(x_center/(X[1] - X[0]))
```

3.34.2.31 Xi

```
setup_vdiff.Xi = ism_values.get("X")
```

3.35 show_data Namespace Reference

Functions

- def colorFader (c1, c2, mix=0)
- def colorArray (c1, c2, n=10)
- def readDataXE (file_name, NX, NE)

  DATA READING ROUTINES #.
- def readInfo (file_number)
- def readAxis (file_name)
- def getData (var, file_number)
- def show (variable, time, position, energy, xlim=None, elim=None, vlim=None, source_center=0, fig_save=False, info=False)

Variables

- elim

  SHOW DATA #.
- vlim
- source_center
- fig_save

3.35.1 Function Documentation

3.35.1.1 colorArray()

```
def show_data.colorArray (
              c1,
              c2,
              n = 10 )
```

3.35.1.2 colorFader()

```
def show_data.colorFader (
              c1,
              c2,
              mix = 0 )
```

3.35.1.3 getData()

```
def show_data.getData (
              var,
              file_number )
```

3.35.1.4 readAxis()

```
def show_data.readAxis (
              file_name )
```

3.35.1.5 readDataXE()

```
def show_data.readDataXE (
              file_name,
              NX,
              NE )
```

DATA READING ROUTINES #.

!!! DO NOT MODIFY !!! #

3.35.1.6 readInfo()

```
def show_data.readInfo (
              file_number )
```

3.35.1.7 show()

```
def show_data.show (
              variable,
              time,
              position,
              energy,
              xlim = None,
              elim = None,
              vlim = None,
              source_center = 0,
              fig_save = False,
              info = False )
```

3.35.2 Variable Documentation

3.35.2.1 elim

```
show_data.elim
```

SHOW DATA #.

3.35.2.2 fig_save

```
show_data.fig_save
```

3.35.2.3 source_center

```
show_data.source_center
```

3.35.2.4 vlim

```
show_data.vlim
```

3.36 ShowInjectionEvolution Namespace Reference

Functions

- def readDataXE (file_name, NX, NE)
- def readAxis (file_name)

Variables

- index = np.logspace(1, np.log10(900), 10)
- figsize
- def X = readAxis("../data_ini/X.dat")
- def E = readAxis("../data_ini/E.dat")
- string loc_id = ""
- def data = readDataXE("../data_out/Pcr_"+loc_id+".dat", 2∗∗11, 2∗∗5)

3.36.1 Function Documentation

3.36.1.1 readAxis()

```
def ShowInjectionEvolution.readAxis (
              file_name )
```

3.36.1.2 readDataXE()

```
def ShowInjectionEvolution.readDataXE (
              file_name,
              NX,
              NE )
```

3.36.2 Variable Documentation

3.36.2.1 data

```
def ShowInjectionEvolution.data = readDataXE("../data_out/Pcr_"+loc_id+".dat", 2**11, 2**5)
```

3.36.2.2 E

```
def ShowInjectionEvolution.E = readAxis("../data_ini/E.dat")
```

3.36.2.3 figsize

```
ShowInjectionEvolution.figsize
```

3.36.2.4 index

```
ShowInjectionEvolution.index = np.logspace(1, np.log10(900), 10)
```

3.36.2.5 loc_id

```
string ShowInjectionEvolution.loc_id = ""
```

3.36.2.6 X

```
def ShowInjectionEvolution.X = readAxis("../data_ini/X.dat")
```

3.37 SNR_evolution Namespace Reference

Functions

- def InverseTrigonalMatrix (T)

  FUNCTIONS IN ORDER TO CREATE A GOOD SPLINE !!! #.
- def ProductMatrix (A, B)
- def InterpolatingSpline (X, Y)
- def Rsh (nt)

Variables

- list marker = ['X', 'o', 's', 'v']
- int size_x = 6
- int size_y = 4
- int sub_x = 1
- int sub_y = 2
- fig = plt.figure(figsize=(size_x∗sub_x,size_y∗sub_y))
- gs = gridspec.GridSpec(ncols= sub_x, nrows = sub_y, figure = fig)
- wspace
- hspace
- ax0 = fig.add_subplot(gs[0])
- pc
- c
- label
- lw
- loc
- ncol
- bbox_to_anchor
- ax1 = fig.add_subplot(gs[1])
- kms

3.37.1 Function Documentation

3.37.1.1 InterpolatingSpline()

```
def SNR_evolution.InterpolatingSpline (
              X,
              Y )
```

3.37.1.2 InverseTrigonalMatrix()

```
def SNR_evolution.InverseTrigonalMatrix (
              T )
```

FUNCTIONS IN ORDER TO CREATE A GOOD SPLINE !!! #.

TriDiagonal matrix inversion function

3.37.1.3 ProductMatrix()

```
def SNR_evolution.ProductMatrix (
              A,
              B )
```

3.37.1.4 Rsh()

```
def SNR_evolution.Rsh (
              nt )
```

3.37.2 Variable Documentation

3.37.2.1 ax0

```
SNR_evolution.ax0 = fig.add_subplot(gs[0])
```

3.37.2.2 ax1

```
SNR_evolution.ax1 = fig.add_subplot(gs[1])
```

3.37.2.3 bbox_to_anchor

```
SNR_evolution.bbox_to_anchor
```

3.37.2.4 c

```
SNR_evolution.c
```

3.37.2.5 fig

```
SNR_evolution.fig = plt.figure(figsize=(size_x*sub_x,size_y*sub_y))
```

3.37.2.6 gs

```
SNR_evolution.gs = gridspec.GridSpec(ncols= sub_x, nrows = sub_y, figure = fig )
```

3.37.2.7 hspace

```
SNR_evolution.hspace
```

3.37.2.8 kms

```
SNR_evolution.kms
```

3.37.2.9 label

```
SNR_evolution.label
```

3.37.2.10 loc

```
SNR_evolution.loc
```

3.37.2.11 lw

```
SNR_evolution.lw
```

3.37.2.12 marker

```
SNR_evolution.marker = ['X', 'o', 's', 'v']
```

3.37.2.13 ncol

```
SNR_evolution.ncol
```

3.37.2.14 pc

```
SNR_evolution.pc
```

3.37.2.15 size_x

```
int SNR_evolution.size_x = 6
```

3.37.2.16 size_y

```
int SNR_evolution.size_y = 4
```

3.37.2.17 sub_x

```
int SNR_evolution.sub_x = 1
```

3.37.2.18 sub_y

```
int SNR_evolution.sub_y = 2
```

3.37.2.19 wspace

```
SNR_evolution.wspace
```

3.38 Split_solvers Namespace Reference

Functions

- def TDMA (a, b, c, d)
- def generalized_diffusion (u, X, D, dt, theta=0.5)

Variables

- int NX = 1000
- int Xmin = -1
- int Xmax = 1
- X = np.linspace(Xmin, Xmax, NX+1)
- int D = np.ones(len(X))∗1e-2
- int u = np.ones(len(X))∗0.
- c
- int t_ini = 0.
- int dt = 1e-1
- int t_max = 1.
- int t = t_ini
- int u_new_0 = u
- int u_old = u_new_0
- int u_new_1 = u

3.38.1 Function Documentation

3.38.1.1 generalized_diffusion()

```
def Split_solvers.generalized_diffusion (
              u,
              X,
              D,
              dt,
              theta = 0.5 )
```

3.38.1.2 TDMA()

```
def Split_solvers.TDMA (
              a,
              b,
              c,
              d )
```

3.38.2 Variable Documentation

3.38.2.1 c

```
Split_solvers.c
```

3.38.2.2 D

```
int Split_solvers.D = np.ones(len(X))*1e-2
```

3.38.2.3 dt

```
int Split_solvers.dt = 1e-1
```

3.38.2.4 NX

```
int Split_solvers.NX = 1000
```

3.38.2.5 t

```
int Split_solvers.t = t_ini
```

3.38.2.6 t_ini

```
int Split_solvers.t_ini = 0.
```

3.38.2.7 t_max

```
int Split_solvers.t_max = 1.
```

3.38.2.8 u

```
Split_solvers.u = np.ones(len(X))*0.
```

3.38.2.9 u_new_0

```
def Split_solvers.u_new_0 = u
```

3.38.2.10 u_new_1

```
def Split_solvers.u_new_1 = u
```

3.38.2.11 u_old

```
int Split_solvers.u_old = u_new_0
```

3.38.2.12 X

```
Split_solvers.X = np.linspace(Xmin, Xmax, NX+1)
```

3.38.2.13 Xmax

```
int Split_solvers.Xmax = 1
```

3.38.2.14 Xmin

```
int Split_solvers.Xmin = -1
```

3.39 test_tesc Namespace Reference

Functions

- def tesc (E)
- def gauss (t, sig, mu)
- def sig (t)

Variables

- float GeV = 0.00160218
- int kyr = 1e3∗24∗60∗60∗365.25
- float rho_0 = 0.35
- float e = 4.8032e-10
- float c = 2.998e10
- float xhi_cr = 0.1
- float xhi_0 = 2.026
- float beta = 0.2
- int Esn = 1e51
- float Emin = 0.1∗GeV
- E = np.logspace(np.log10(10.∗GeV), np.log10(1e3∗GeV), 100)
- t = np.linspace(0.01∗kyr, 1e3∗kyr, 10000)
- Qcr = np.empty((len(E), len(t)))
- figsize
- label

3.39.1 Function Documentation

3.39.1.1 gauss()

```
def test_tesc.gauss (
              t,
              sig,
              mu )
```

3.39.1.2 sig()

```
def test_tesc.sig (
              t )
```

3.39.1.3 tesc()

```
def test_tesc.tesc (
              E )
```

3.39.2 Variable Documentation

3.39.2.1 beta

```
float test_tesc.beta = 0.2
```

3.39.2.2 c

```
float test_tesc.c = 2.998e10
```

3.39.2.3 e

```
float test_tesc.e = 4.8032e-10
```

3.39.2.4 E

```
test_tesc.E = np.logspace(np.log10(10.*GeV), np.log10(1e3*GeV), 100)
```

3.39.2.5 Emin

```
float test_tesc.Emin = 0.1*GeV
```

3.39.2.6 Esn

```
int test_tesc.Esn = 1e51
```

3.39.2.7 figsize

```
test_tesc.figsize
```

3.39.2.8 GeV

```
float test_tesc.GeV = 0.00160218
```

3.39.2.9 kyr

```
int test_tesc.kyr = 1e3*24*60*60*365.25
```

3.39.2.10 label

```
test_tesc.label
```

3.39.2.11 Qcr

```
test_tesc.Qcr = np.empty((len(E), len(t)))
```

3.39.2.12 rho_0

```
float test_tesc.rho_0 = 0.35
```

3.39.2.13 t

```
test_tesc.t = np.linspace(0.01*kyr, 1e3*kyr, 10000)
```

3.39.2.14 xhi_0

```
float test_tesc.xhi_0 = 2.026
```

3.39.2.15 xhi_cr

```
float test_tesc.xhi_cr = 0.1
```

Chapter 4

File Documentation

4.1 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/data_analysis/pcr_ip_2D.py File Reference

Namespaces

- pcr_ip_2D

Functions

- def pcr_ip_2D.readDataXE (file_name, NX, NE)
- def pcr_ip_2D.readAxis (file_name)
- def pcr_ip_2D.getData (var, file_number)
- def pcr_ip_2D.getTimeID (time_test, delta_t, t_ini, kind="linear")

Variables

- int pcr_ip_2D.t_ini = 0.∗cst.kyr
- int pcr_ip_2D.t_max = 200.∗cst.kyr
- float pcr_ip_2D.delta_t = 0.1∗cst.kyr
- int pcr_ip_2D.x_center = 1000.
- float pcr_ip_2D.time_test = 5.9∗cst.kyr
- def pcr_ip_2D.out_id = getTimeID(time_test, delta_t, t_ini)
- pcr_ip_2D.X
- pcr_ip_2D.E
- pcr_ip_2D.Pcr
- pcr_ip_2D.Ip
- pcr_ip_2D.EV
- pcr_ip_2D.XV
- pcr_ip_2D.sparse
- pcr_ip_2D.False
- pcr_ip_2D.indexing
- pcr_ip_2D.cmap = plt.get_cmap('jet')
- pcr_ip_2D.XV_log = XV/cst.pc
- pcr_ip_2D.EV_log = np.log10(EV/cst.GeV)
- pcr_ip_2D.ax0

- pcr_ip_2D.ax1
- pcr_ip_2D.ncols
- pcr_ip_2D.sharey
- pcr_ip_2D.figsize
- pcr_ip_2D.im0 = ax0.pcolormesh(XV_log-x_center, EV_log, np.log10(Pcr), cmap=cmap)
- pcr_ip_2D.ax
- pcr_ip_2D.cax
- pcr_ip_2D.label
- pcr_ip_2D.im1 = ax1.pcolormesh(XV_log-x_center, EV_log, np.log10(Ip), cmap=cmap)
- pcr_ip_2D.fontsize

4.2 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/data_analysis/show_data.py File Reference

Namespaces

- show_data

Functions

- def show_data.colorFader (c1, c2, mix=0)
- def show_data.colorArray (c1, c2, n=10)
- def show_data.readDataXE (file_name, NX, NE)

  DATA READING ROUTINES #.
- def show_data.readInfo (file_number)
- def show_data.readAxis (file_name)
- def show_data.getData (var, file_number)
- def show_data.show (variable, time, position, energy, xlim=None, elim=None, vlim=None, source_center=0, fig_save=False, info=False)

Variables

- show_data.elim

  SHOW DATA #.
- show_data.vlim
- show_data.source_center
- show_data.fig_save

4.3 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/namelist.py File Reference

Namespaces

- namelist

Functions

- def namelist.getVA (E, phase)
- def namelist.getDamping (E, phase)

Variables

- string namelist.folder_name = "Test_standard_full"

  OUTPUT FOLDER CREATOR #.
- string namelist.folder_path = "../WorkFolder/"
- string namelist.total_path = folder_path+folder_name
- int namelist.NX = 10

  GRID PARAMETERS #.
- int namelist.NE = 7
- int namelist.Xmin = 0.∗cst.pc
- int namelist.Xmax = 2000.∗cst.pc
- string namelist.xgridtype = "cartesian"
- float namelist.Emin = 0.99∗cst.GeV
- float namelist.Emax = 50.01∗cst.TeV
- string namelist.egridtype = "logspace"
- int namelist.box_center = 1000.∗cst.pc
- namelist.X = grid.grid(Xmin, Xmax, 2∗∗NX, xgridtype, s_center = box_center)
- namelist.E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)
- bool namelist.in_damping = True

  OTHER TERMS #.
- bool namelist.lz_damping = True
- bool namelist.nlld_damping = True
- int namelist.Pcr_1GeV = 1∗cst.eV
- int namelist.Pe_1GeV = 1e-2∗cst.eV
- string namelist.bdiff_model = "ISM_independant"
- list namelist.phases = [ ]

  ISM STRUCTURE #.
- list namelist.smooth_width_transition = [10.∗cst.pc, 3.∗cst.pc, 3.∗cst.pc, 10.∗cst.pc, 10.∗cst.pc, 3.∗cst.pc, 3.∗cst.pc, 10.∗cst.pc]
- namelist.T
- namelist.B
- namelist.ni
- namelist.nn
- namelist.nt
- namelist.Xi
- namelist.mi
- namelist.mn
- namelist.va
- namelist.gamma_in
- namelist.gamma_lz
- namelist.ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va, gamma_in = gamma_in, gamma_lz = gamma_lz)

4.4 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/other_setups/fiducial↩ _tests/phases_energy_dependance/namelist_uniform.py File Reference

Namespaces

- namelist_uniform

Functions

- def namelist_uniform.getVA (E, phase)
- def namelist_uniform.getDamping (E, phase)

Variables

- string namelist_uniform.folder_name = "WNM-CNM-DiM_all_dependant"

  OUTPUT FOLDER CREATOR #.
- string namelist_uniform.folder_path = "../../../../WorkFolder/Fiducial_tests_for_thesis_2/"
- string namelist_uniform.total_path = folder_path+folder_name
- int namelist_uniform.NX = 12

  GRID PARAMETERS #.
- int namelist_uniform.NE = 8
- int namelist_uniform.Xmin = 0.∗cst.pc
- int namelist_uniform.Xmax = 2000.∗cst.pc
- string namelist_uniform.xgridtype = "cartesian"
- float namelist_uniform.Emin = 0.99∗cst.GeV
- float namelist_uniform.Emax = 50.01∗cst.TeV
- string namelist_uniform.egridtype = "logspace"
- int namelist_uniform.box_center = 1000.∗cst.pc
- namelist_uniform.X = grid.grid(Xmin, Xmax, 2∗∗NX, xgridtype, s_center = box_center)
- namelist_uniform.E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)
- bool namelist_uniform.in_damping = True

  OTHER TERMS #.
- bool namelist_uniform.lz_damping = True
- bool namelist_uniform.nlld_damping = True
- int namelist_uniform.Pcr_1GeV = 1∗cst.eV
- int namelist_uniform.Pe_1GeV = 1e-2∗cst.eV
- string namelist_uniform.bdiff_model = "ISM_dependant"
- list namelist_uniform.phases = [ ]

  ISM STRUCTURE #.
- list namelist_uniform.smooth_width_transition = [10.∗cst.pc, 3.∗cst.pc, 3.∗cst.pc, 10.∗cst.pc, 10.∗cst.pc, 3.∗cst.pc, 3.∗cst.pc, 10.∗cst.pc]
- namelist_uniform.T
- namelist_uniform.B
- namelist_uniform.ni
- namelist_uniform.nn
- namelist_uniform.nt
- namelist_uniform.Xi
- namelist_uniform.mi
- namelist_uniform.mn
- namelist_uniform.va
- namelist_uniform.gamma_in
- namelist_uniform.gamma_lz
- namelist_uniform.ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va, gamma_in = gamma_in, gamma_lz = gamma_lz)

4.5 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/other_setups/fiducial_tests/phases_energy_dependance/setup_uniform.py File Reference

Namespaces

- setup_uniform

Variables

- setup_uniform.X = nml.X
- setup_uniform.E = nml.E
- setup_uniform.nx = nml.NX

  END : INITIAL ISM CONDITIONS #.
- setup_uniform.ne = nml.NE
- setup_uniform.x_center = nml.box_center
- setup_uniform.x_center_index = int(x_center/(X[1] - X[0]))
- setup_uniform.ism_values = nml.ism_values
- setup_uniform.B = ism_values.get("B")
- setup_uniform.nn = ism_values.get("nn")
- setup_uniform.ni = ism_values.get("ni")
- setup_uniform.mn = ism_values.get("mn")
- setup_uniform.mi = ism_values.get("mi")
- setup_uniform.T = ism_values.get("T")
- setup_uniform.Xi = ism_values.get("X")
- setup_uniform.va = ism_values.get("VA")
- setup_uniform.g_in = ism_values.get("gamma_in")
- setup_uniform.g_lz = ism_values.get("gamma_lz")
- setup_uniform.d00 = np.zeros(len(X))

  INITIAL ISM CONDITIONS #.
- setup_uniform.D = np.zeros((len(E), len(X)))
- setup_uniform.Db = np.zeros((len(E), len(X)))
- setup_uniform.Ip = np.zeros((len(E), len(X)))
- setup_uniform.Im = np.zeros((len(E), len(X)))
- setup_uniform.VA = np.zeros((len(E), len(X)))
- setup_uniform.gamma_in = np.zeros((len(E), len(X)))
- setup_uniform.gamma_lazarian = np.zeros((len(E), len(X)))
- setup_uniform.gamma_nlld = np.zeros((len(E), len(X)))
- setup_uniform.gamma_tot = np.zeros((len(E), len(X)))
- setup_uniform.Pcr = np.zeros((len(E), len(X)))
- setup_uniform.Pe = np.zeros((len(E), len(X)))
- dictionary setup_uniform.medium_props
- setup_uniform.mass
- setup_uniform.kmin
- setup_uniform.q
- setup_uniform.l
- setup_uniform.in_damping = dp.indamping_alfven(xi , E[e], ism_values)
- setup_uniform.variable
- setup_uniform.path
- dictionary setup_uniform.variables
- setup_uniform.ext

4.6 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/other_setups/namelist_adv.py File Reference

Namespaces

- namelist_adv

Functions

- def namelist_adv.getVA (E, phase)

Variables

- string namelist_adv.folder_name = "advc_z_X12"

  OUTPUT FOLDER CREATOR #.
- string namelist_adv.folder_path = "../../WorkFolder/Fiducial_tests_for_thesis/"
- string namelist_adv.total_path = folder_path+folder_name
- int namelist_adv.NX = 12

  GRID PARAMETERS #.
- int namelist_adv.NE = 4
- int namelist_adv.Xmin = 0.∗cst.pc
- int namelist_adv.Xmax = 2000.∗cst.pc
- string namelist_adv.xgridtype = "cartesian"
- int namelist_adv.Emin = 10.∗cst.GeV
- int namelist_adv.Emax = 10.∗cst.TeV
- string namelist_adv.egridtype = "logspace"
- int namelist_adv.box_center = 1000.∗cst.pc
- namelist_adv.X
- namelist_adv.E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)
- bool namelist_adv.in_damping = True

  OTHER TERMS #.
- bool namelist_adv.lz_damping = True
- bool namelist_adv.nlld_damping = True
- int namelist_adv.Pcr_1GeV = 1∗cst.eV
- int namelist_adv.Pe_1GeV = 1∗cst.eV
- string namelist_adv.bdiff_model = "ISM_independant"
- list namelist_adv.phases = [ ]

  ISM STRUCTURE #.
- int namelist_adv.smooth_width_transition = 10.∗cst.pc
- namelist_adv.T
- namelist_adv.B
- namelist_adv.ni
- namelist_adv.nn
- namelist_adv.nt
- namelist_adv.Xi
- namelist_adv.mi
- namelist_adv.mn
- namelist_adv.va
- namelist_adv.ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va)

4.7 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/other_setups/namelist_adve.py File Reference

Namespaces

- namelist_adve

Functions

- def namelist_adve.getVA (E, phase)

Variables

- string namelist_adve.folder_name = "adv_e_X6"

  OUTPUT FOLDER CREATOR #.
- string namelist_adve.folder_path = "../../WorkFolder/Fiducial_tests_for_thesis/"
- string namelist_adve.total_path = folder_path+folder_name
- int namelist_adve.NX = 6

  GRID PARAMETERS #.
- int namelist_adve.NE = 6
- int namelist_adve.Xmin = 0.∗cst.pc
- int namelist_adve.Xmax = 2000.∗cst.pc
- string namelist_adve.xgridtype = "cartesian"
- int namelist_adve.Emin = 10.∗cst.GeV
- int namelist_adve.Emax = 10.∗cst.TeV
- string namelist_adve.egridtype = "logspace"
- int namelist_adve.box_center = 1000.∗cst.pc
- namelist_adve.X
- namelist_adve.E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)
- bool namelist_adve.in_damping = True

  OTHER TERMS #.
- bool namelist_adve.lz_damping = True
- bool namelist_adve.nlld_damping = True
- int namelist_adve.Pcr_1GeV = 1∗cst.eV
- int namelist_adve.Pe_1GeV = 1∗cst.eV
- string namelist_adve.bdiff_model = "ISM_independant"
- list namelist_adve.phases = [ ]

  ISM STRUCTURE #.
- int namelist_adve.smooth_width_transition = 10.∗cst.pc
- namelist_adve.T
- namelist_adve.B
- namelist_adve.ni
- namelist_adve.nn
- namelist_adve.nt
- namelist_adve.Xi
- namelist_adve.mi
- namelist_adve.mn
- namelist_adve.va
- namelist_adve.ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va)

4.8 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/other_setups/namelist_advst.py File Reference

Namespaces

- namelist_advst

Functions

- def namelist_advst.getVA (E, phase)

Variables

- string namelist_advst.folder_name = "adv_sss_E6"

  OUTPUT FOLDER CREATOR #.
- string namelist_advst.folder_path = "../../WorkFolder/Fiducial_tests_for_thesis/"
- string namelist_advst.total_path = folder_path+folder_name
- int namelist_advst.NX = 4

  GRID PARAMETERS #.
- int namelist_advst.NE = 6
- int namelist_advst.Xmin = 0.∗cst.pc
- int namelist_advst.Xmax = 2000.∗cst.pc
- string namelist_advst.xgridtype = "cartesian"
- int namelist_advst.Emin = 10.∗cst.GeV
- int namelist_advst.Emax = 10.∗cst.TeV
- string namelist_advst.egridtype = "logspace"
- int namelist_advst.box_center = 1000.∗cst.pc
- namelist_advst.X
- namelist_advst.E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)
- bool namelist_advst.in_damping = True

  OTHER TERMS #.
- bool namelist_advst.lz_damping = True
- bool namelist_advst.nlld_damping = True
- int namelist_advst.Pcr_1GeV = 1∗cst.eV
- int namelist_advst.Pe_1GeV = 1∗cst.eV
- string namelist_advst.bdiff_model = "ISM_independant"
- list namelist_advst.phases = [ ]

  ISM STRUCTURE #.
- int namelist_advst.smooth_width_transition = 10.∗cst.pc
- namelist_advst.T
- namelist_advst.B
- namelist_advst.ni
- namelist_advst.nn
- namelist_advst.nt
- namelist_advst.Xi
- namelist_advst.mi
- namelist_advst.mn
- namelist_advst.va
- namelist_advst.ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va)

4.9 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/other_setups/namelist_diff.py File Reference

Namespaces

- namelist_diff

Functions

- def namelist_diff.getVA (E, phase)

Variables

- string namelist_diff.folder_name = "diff_z_X12"

  OUTPUT FOLDER CREATOR #.
- string namelist_diff.folder_path = "../../WorkFolder/Fiducial_tests_for_thesis/"
- string namelist_diff.total_path = folder_path+folder_name
- int namelist_diff.NX = 12

  GRID PARAMETERS #.
- int namelist_diff.NE = 4
- int namelist_diff.Xmin = 0.∗cst.pc
- int namelist_diff.Xmax = 2000.∗cst.pc
- string namelist_diff.xgridtype = "cartesian"
- int namelist_diff.Emin = 10.∗cst.GeV
- int namelist_diff.Emax = 10.∗cst.TeV
- string namelist_diff.egridtype = "logspace"
- int namelist_diff.box_center = 1000.∗cst.pc
- namelist_diff.X
- namelist_diff.E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)
- bool namelist_diff.in_damping = True

  OTHER TERMS #.
- bool namelist_diff.lz_damping = True
- bool namelist_diff.nlld_damping = True
- int namelist_diff.Pcr_1GeV = 1∗cst.eV
- int namelist_diff.Pe_1GeV = 1∗cst.eV
- string namelist_diff.bdiff_model = "ISM_independant"
- list namelist_diff.phases = [ ]

  ISM STRUCTURE #.
- int namelist_diff.smooth_width_transition = 10.∗cst.pc
- namelist_diff.T
- namelist_diff.B
- namelist_diff.ni
- namelist_diff.nn
- namelist_diff.nt
- namelist_diff.Xi
- namelist_diff.mi
- namelist_diff.mn
- namelist_diff.va
- namelist_diff.ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va)

4.10 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/other_setups/namelist_vdiff.py File Reference

Namespaces

- namelist_vdiff

Functions

- def namelist_vdiff.getVA (E, phase)

Variables

- string namelist_vdiff.folder_name = "vdiff_z_X14"

  OUTPUT FOLDER CREATOR #.
- string namelist_vdiff.folder_path = "../../WorkFolder/Fiducial_tests_for_thesis/"
- string namelist_vdiff.total_path = folder_path+folder_name
- int namelist_vdiff.NX = 14

  GRID PARAMETERS #.
- int namelist_vdiff.NE = 4
- int namelist_vdiff.Xmin = 0.∗cst.pc
- int namelist_vdiff.Xmax = 2000.∗cst.pc
- string namelist_vdiff.xgridtype = "cartesian"
- int namelist_vdiff.Emin = 10.∗cst.GeV
- int namelist_vdiff.Emax = 10.∗cst.TeV
- string namelist_vdiff.egridtype = "logspace"
- int namelist_vdiff.box_center = 1000.∗cst.pc
- namelist_vdiff.X
- namelist_vdiff.E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)
- bool namelist_vdiff.in_damping = True

  OTHER TERMS #.
- bool namelist_vdiff.lz_damping = True
- bool namelist_vdiff.nlld_damping = True
- int namelist_vdiff.Pcr_1GeV = 1∗cst.eV
- int namelist_vdiff.Pe_1GeV = 1∗cst.eV
- string namelist_vdiff.bdiff_model = "ISM_independant"
- list namelist_vdiff.phases = [ ]

  ISM STRUCTURE #.
- int namelist_vdiff.smooth_width_transition = 10.∗cst.pc
- namelist_vdiff.T
- namelist_vdiff.B
- namelist_vdiff.ni
- namelist_vdiff.nn
- namelist_vdiff.nt
- namelist_vdiff.Xi
- namelist_vdiff.mi
- namelist_vdiff.mn
- namelist_vdiff.va
- namelist_vdiff.ism_values = dict(T=T, B=B, ni=ni, nn=nn, nt=nt, X=Xi, mi=mi, mn=mn, VA=va)

4.11 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/other_setups/setup_adv.py File Reference

Namespaces

- setup_adv

Functions

- def setup_adv.door (X, X1, X2, V)

Variables

- setup_adv.X = nml.X
- setup_adv.E = nml.E
- setup_adv.nx = nml.NX

  END : INITIAL ISM CONDITIONS #.
- setup_adv.ne = nml.NE
- setup_adv.x_center = nml.box_center
- setup_adv.x_center_index = int(x_center/(X[1] - X[0]))
- setup_adv.ism_values = nml.ism_values
- setup_adv.B = ism_values.get("B")
- setup_adv.nn = ism_values.get("nn")
- setup_adv.ni = ism_values.get("ni")
- setup_adv.mn = ism_values.get("mn")
- setup_adv.mi = ism_values.get("mi")
- setup_adv.T = ism_values.get("T")
- setup_adv.Xi = ism_values.get("X")
- setup_adv.va = ism_values.get("VA")
- setup_adv.d00 = np.zeros(len(X))

  INITIAL ISM CONDITIONS #.
- setup_adv.D = np.zeros((len(E), len(X)))
- setup_adv.Db = np.zeros((len(E), len(X)))
- setup_adv.lp = np.zeros((len(E), len(X)))
- setup_adv.lm = np.zeros((len(E), len(X)))
- setup_adv.VA = np.zeros((len(E), len(X)))
- setup_adv.gamma_in = np.zeros((len(E), len(X)))
- setup_adv.gamma_lazarian = np.zeros((len(E), len(X)))
- setup_adv.gamma_nlld = np.zeros((len(E), len(X)))
- setup_adv.gamma_tot = np.zeros((len(E), len(X)))
- setup_adv.Pcr = np.zeros((len(E), len(X)))
- setup_adv.Pe = np.zeros((len(E), len(X)))
- setup_adv.variable
- setup_adv.path
- dictionary setup_adv.variables
- setup_adv.ext

4.12 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/other_setups/setup_adve.py File Reference

Namespaces

- setup_adve

Functions

- def setup_adve.door (X, X1, X2, V)
- def setup_adve.spec (E, q)

Variables

- setup_adve.X = nml.X
- setup_adve.E = nml.E
- setup_adve.nx = nml.NX

  END : INITIAL ISM CONDITIONS #.
- setup_adve.ne = nml.NE
- setup_adve.x_center = nml.box_center
- setup_adve.x_center_index = int(x_center/(X[1] - X[0]))
- setup_adve.ism_values = nml.ism_values
- setup_adve.B = ism_values.get("B")
- setup_adve.nn = ism_values.get("nn")
- setup_adve.ni = ism_values.get("ni")
- setup_adve.mn = ism_values.get("mn")
- setup_adve.mi = ism_values.get("mi")
- setup_adve.T = ism_values.get("T")
- setup_adve.Xi = ism_values.get("X")
- setup_adve.va = ism_values.get("VA")
- setup_adve.d00 = np.zeros(len(X))

  INITIAL ISM CONDITIONS #.
- setup_adve.D = np.zeros((len(E), len(X)))
- setup_adve.Db = np.zeros((len(E), len(X)))
- setup_adve.Ip = np.zeros((len(E), len(X)))
- setup_adve.Im = np.zeros((len(E), len(X)))
- setup_adve.VA = np.zeros((len(E), len(X)))
- setup_adve.gamma_in = np.zeros((len(E), len(X)))
- setup_adve.gamma_lazarian = np.zeros((len(E), len(X)))
- setup_adve.gamma_nlld = np.zeros((len(E), len(X)))
- setup_adve.gamma_tot = np.zeros((len(E), len(X)))
- setup_adve.Pcr = np.zeros((len(E), len(X)))
- setup_adve.Pe = np.zeros((len(E), len(X)))
- setup_adve.variable
- setup_adve.path
- dictionary setup_adve.variables
- setup_adve.ext

4.13 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/other_setups/setup_advst.py File Reference

Namespaces

- setup_advst

Functions

- def setup_advst.door (X, X1, X2, V)
- def setup_advst.spec (E, q)

Variables

- setup_advst.X = nml.X
- setup_advst.E = nml.E
- setup_advst.nx = nml.NX

  END : INITIAL ISM CONDITIONS #.
- setup_advst.ne = nml.NE
- setup_advst.x_center = nml.box_center
- setup_advst.x_center_index = int(x_center/(X[1] - X[0]))
- setup_advst.ism_values = nml.ism_values
- setup_advst.B = ism_values.get("B")
- setup_advst.nn = ism_values.get("nn")
- setup_advst.ni = ism_values.get("ni")
- setup_advst.mn = ism_values.get("mn")
- setup_advst.mi = ism_values.get("mi")
- setup_advst.T = ism_values.get("T")
- setup_advst.Xi = ism_values.get("X")
- setup_advst.va = ism_values.get("VA")
- setup_advst.d00 = np.zeros(len(X))

  INITIAL ISM CONDITIONS #.
- setup_advst.D = np.zeros((len(E), len(X)))
- setup_advst.Db = np.zeros((len(E), len(X)))
- setup_advst.Ip = np.zeros((len(E), len(X)))
- setup_advst.Im = np.zeros((len(E), len(X)))
- setup_advst.VA = np.zeros((len(E), len(X)))
- setup_advst.gamma_in = np.zeros((len(E), len(X)))
- setup_advst.gamma_lazarian = np.zeros((len(E), len(X)))
- setup_advst.gamma_nlld = np.zeros((len(E), len(X)))
- setup_advst.gamma_tot = np.zeros((len(E), len(X)))
- setup_advst.Pcr = np.zeros((len(E), len(X)))
- setup_advst.Pe = np.zeros((len(E), len(X)))
- setup_advst.variable
- setup_advst.path
- dictionary setup_advst.variables
- setup_advst.ext

4.14 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/other_setups/setup_diff.py File Reference

Namespaces

- setup_diff

Functions

- def setup_diff.door (X, X1, X2, V)

Variables

- setup_diff.X = nml.X
- setup_diff.E = nml.E
- setup_diff.nx = nml.NX

  END : INITIAL ISM CONDITIONS #.
- setup_diff.ne = nml.NE
- setup_diff.x_center = nml.box_center
- setup_diff.x_center_index = int(x_center/(X[1] - X[0]))
- setup_diff.ism_values = nml.ism_values
- setup_diff.B = ism_values.get("B")
- setup_diff.nn = ism_values.get("nn")
- setup_diff.ni = ism_values.get("ni")
- setup_diff.mn = ism_values.get("mn")
- setup_diff.mi = ism_values.get("mi")
- setup_diff.T = ism_values.get("T")
- setup_diff.Xi = ism_values.get("X")
- setup_diff.va = ism_values.get("VA")
- setup_diff.d00 = np.zeros(len(X))

  INITIAL ISM CONDITIONS #.
- setup_diff.D = np.zeros((len(E), len(X)))
- setup_diff.Db = np.zeros((len(E), len(X)))
- setup_diff.Ip = np.zeros((len(E), len(X)))
- setup_diff.Im = np.zeros((len(E), len(X)))
- setup_diff.VA = np.zeros((len(E), len(X)))
- setup_diff.gamma_in = np.zeros((len(E), len(X)))
- setup_diff.gamma_lazarian = np.zeros((len(E), len(X)))
- setup_diff.gamma_nlld = np.zeros((len(E), len(X)))
- setup_diff.gamma_tot = np.zeros((len(E), len(X)))
- setup_diff.Pcr = np.zeros((len(E), len(X)))
- setup_diff.Pe = np.zeros((len(E), len(X)))
- setup_diff.variable
- setup_diff.path
- dictionary setup_diff.variables
- setup_diff.ext

4.15 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/other_setups/setup_vdiff.py File Reference

Namespaces

- setup_vdiff

Functions

- def setup_vdiff.door (X, X1, X2, V)
- def setup_vdiff.f (X, X1=900.*cst.pc, X2=1100.*cst.pc, sig=20.*cst.pc, R=1e-3)

Variables

- setup_vdiff.X = nml.X
- setup_vdiff.E = nml.E
- setup_vdiff.nx = nml.NX

  END : INITIAL ISM CONDITIONS #.
- setup_vdiff.ne = nml.NE
- setup_vdiff.x_center = nml.box_center
- setup_vdiff.x_center_index = int(x_center/(X[1] - X[0]))
- setup_vdiff.ism_values = nml.ism_values
- setup_vdiff.B = ism_values.get("B")
- setup_vdiff.nn = ism_values.get("nn")
- setup_vdiff.ni = ism_values.get("ni")
- setup_vdiff.mn = ism_values.get("mn")
- setup_vdiff.mi = ism_values.get("mi")
- setup_vdiff.T = ism_values.get("T")
- setup_vdiff.Xi = ism_values.get("X")
- setup_vdiff.va = ism_values.get("VA")
- setup_vdiff.d00 = np.zeros(len(X))

  INITIAL ISM CONDITIONS #.
- setup_vdiff.D = np.zeros((len(E), len(X)))
- setup_vdiff.Db = np.zeros((len(E), len(X)))
- setup_vdiff.Ip = np.zeros((len(E), len(X)))
- setup_vdiff.Im = np.zeros((len(E), len(X)))
- setup_vdiff.VA = np.zeros((len(E), len(X)))
- setup_vdiff.gamma_in = np.zeros((len(E), len(X)))
- setup_vdiff.gamma_lazarian = np.zeros((len(E), len(X)))
- setup_vdiff.gamma_nlld = np.zeros((len(E), len(X)))
- setup_vdiff.gamma_tot = np.zeros((len(E), len(X)))
- setup_vdiff.Pcr = np.zeros((len(E), len(X)))
- setup_vdiff.Pe = np.zeros((len(E), len(X)))
- setup_vdiff.variable
- setup_vdiff.path
- dictionary setup_vdiff.variables
- setup_vdiff.ext

4.16 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/setup.py File Reference

Namespaces

- setup

Variables

- setup.X = nml.X
- setup.E = nml.E
- setup.nx = nml.NX

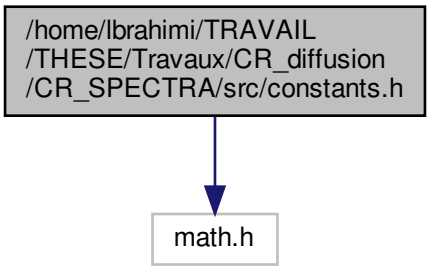
  END : INITIAL ISM CONDITIONS #.
- setup.ne = nml.NE
- setup.x_center = nml.box_center
- setup.x_center_index = int(x_center/(X[1] - X[0]))
- setup.ism_values = nml.ism_values
- setup.B = ism_values.get("B")
- setup.nn = ism_values.get("nn")
- setup.ni = ism_values.get("ni")
- setup.mn = ism_values.get("mn")
- setup.mi = ism_values.get("mi")
- setup.T = ism_values.get("T")
- setup.Xi = ism_values.get("X")
- setup.va = ism_values.get("VA")
- setup.g_in = ism_values.get("gamma_in")
- setup.g_lz = ism_values.get("gamma_lz")
- setup.d00 = np.zeros(len(X))

  INITIAL ISM CONDITIONS #.
- setup.D = np.zeros((len(E), len(X)))
- setup.Db = np.zeros((len(E), len(X)))
- setup.lp = np.zeros((len(E), len(X)))
- setup.lm = np.zeros((len(E), len(X)))
- setup.VA = np.zeros((len(E), len(X)))
- setup.gamma_in = np.zeros((len(E), len(X)))
- setup.gamma_lazarian = np.zeros((len(E), len(X)))
- setup.gamma_nlld = np.zeros((len(E), len(X)))
- setup.gamma_tot = np.zeros((len(E), len(X)))
- setup.Pcr = np.zeros((len(E), len(X)))
- setup.Pe = np.zeros((len(E), len(X)))
- dictionary setup.medium_props
- setup.mass
- setup.kmin
- setup.q
- setup.l
- setup.in_damping = dp.indamping_alfven(xi , E[e], ism_values)
- setup.variable
- setup.path
- dictionary setup.variables
- setup.ext

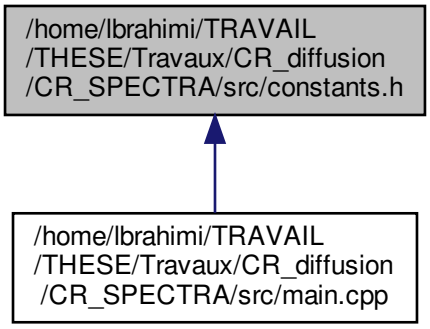
4.17 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/src/constants.h File Reference

```
#include <math.h>
```

Include dependency graph for constants.h:



This graph shows which files directly or indirectly include this file:



Variables

- const double pi = 3.1472

  Inclusion of basic mathematic functions.
- const double yr = 3.154e+7
- const double kyr = 1e3∗yr

  1 yr in [s]
- const double km = 1e5

  1 kyr in [s]
- const double pc = 3.086e18

1 km in [cm]

- const double kpc = 1.e3∗pc

  1 pc in [cm]
- const double GeV = 0.00160218

  1 kpc in [cm]
- const double TeV = 1e3∗GeV

  1 GeV in [erg]
- const double eV = GeV∗1e-9

  1 TeV in [erg]
- const double MeV = 1e-3∗GeV

  1 eV in [erg]
- const double mp = 1.6726219e-24

  1 MeV in [erg]
- const double mn = 1.6749286e-24

  Proton mass [g].
- const double me = 9.1095e-28

  Neutron mass [g].
- const double mHI = mp

  Electron mass [g].
- const double mHII = mp

  HI mass [g].
- const double mHeI = 2∗mp + 2∗mn

  HII mass [g].
- const double mCII = 6∗mp + 6∗mn

  HeI mass [g].
- const double mH2 = 2∗mp

  CII mass [g].
- const double e = 4.80326e-10

  H2 mass [g].
- const double c = 29979245800.

  e charge in [statC]
- const double kbolz = 1.3807e-16

  light celerity in [cm/s]
- const double kms = 1e5

  Boltzmann constant in CGS.
- const double sig_T = 6.65e-25

  1 km/s in cm/s
- const int solver_PcrAdvection = 1

  [cm^ 2] Thomson cross section (see Schlickeiser (2002) p.80)
- const int solver_PcrDiffusion = 1

  Advective term of the CR Pressure (the classical one -> V_A∗grad ...)
- const int solver_PcrAdvection2 = 1

  Diffusive term of the CR Pressure.
- const int solver_PcrAdvectionE = 1

  Explicit Advection solver for Pcr by the energy derivative of Alfvén velocity.
- const int solver_PcrSource1 = 1

  Explicit Advection solver for Pcr in energy cdVAdX.
- const int solver_PcrSource2 = 1

  Source term effect due to the dependance of the Alfvén velocity to the space.
- const int solver_PcrPerpDiff = 0

  Source term effect due to the CR injection from the source in the system.

- const int solver_PeAdvection = 1

  Perpendicular diffusion of CRs after the coherence length.
- const int solver_PeDiffusion = 1

  Advective term of the e- Pressure (the classical one -> V_A∗grad ...)
- const int solver_PeAdvection2 = 1

  Diffusive term of the e- Pressure.
- const int solver_PeAdvectionE = 1

  Explicit Advection solver for e- by the energy derivative of Alfvén velocity.
- const int solver_PeAdvectionE1 = 1

  Explicit Advection solver for e- in energy cdVAdX.
- const int solver_PeAdvectionE2 = 1

  Sychrotron radiations of e- (looses of energy) - Advection term.
- const int solver_PeSource1 = 1

  Synchrotron radiations of e- (looses of energy) - source term.
- const int solver_PeSource2 = 1

  Source term effect due to the dependance of the Alfvén velocity to the space (for e-)
- const int solver_PePerpDiff = 0

  Source term effect due to the e- injection from the source in the system.
- const int solver_IpAdvection = 1

  Perpendicular diffusion of e- after the coherence length.
- const int solver_ImAdvection = 1

  Advective term of the foward waves.
- const int solver_IpSource1 = 1

  Advective term of the backward waves.
- const int solver_ImSource1 = 1

  Source term effect applied on foward waves due to the dependance of the Alfvén velocity to the space.
- const int solver_IpDampGrowth = 1

  Source term effect applied on backward waves due to the dependance of the Alfvén velocity to the space.
- const int solver_ImDampGrowth = 1

  Source term effect due to production of self-turbulence - damping applied on foward waves.
- const int solver_Dilution = 0

  Source term effect due to production of self-turbulence - damping applied on backward waves.
- const int set_background = 1
- const double step_implicit = 20.∗yr

  If need to perform some test without background conditions (1 : On, 0 : off)
- const int source_terms_exact = 1
- const int nproc = 1

  The way to solve the source terms : 1 -> Exact solutions, 0 -> 1st order numerical solution.
- const int output_freq = 0

  Number of processors for the run (! Still experimental)
- const double t_data_out_min = 0.∗kyr

  Model of output frequency (0 : n output between t_start and t_end, 1 : 1 output each n timestep) n = number_out_data.
- const double t_data_out_max = 500.∗kyr

  Instant of the first output data.
- const int number_out_data = 100

  200.∗kyr; Instant of the last output data
- const int time_distrib_of_data = 1

  Total number of output data.
- const double log_first_data = 3e-1∗kyr
- const int delta_log_output = 100

  Time value of the first output in the logscaled output method.

- const double Tmax = 500.1∗kyr

  Number of time-step between two LogOutput.
- const int verbose = 0

  200.1∗kyr; Define the limit time of your simulation
- const double ttau_sat = - log(0.1)/0.1

  0 : False, 1 : True -> Show extra informations during the simulation
- const double Esn = 1
- const double Mej = 1

  in units of 1e51 erg : total energy released by SNR
- const double xi_n = 1

  Msun : total mass released by SNR in sun mass units.
- const double phi_c = 1

  For solar abundances.
- const double bbeta = 2

  Actual thermal cond. / the Sptitzer (1962) value.
- const double C06 = 1.
- const double xhi_cr = 0.1
- const double xhi_0 = 2.026

  Efficiency of CRs acceleration.
- const double gam = 2.2
- const int injection_cutoff = 0

  CRs injection energy power law index.
- const double inj_exp_alpha = 1
- const double Emin = 0.1∗GeV

  Factor of the exponential cutoff in the CRs injection spectra (dN(E)/dE ∼ exp(-inj_exp_alpha∗E/E_Max))
- const double delta = 4.

  Minimum accelered CRs during the Sedov phase.
- const int injection_shape_time = 0

  From Celli et al. (2019) - see Brahimi et al. (2020)
- const double t_start_injection = 1e-6∗kyr

  0 : Time Dirac CRs, 1 : Time Gaussian CRs
- const double t_end_injection = 2

  Time start CRs injection function.
- const double injection_function_width = 10.

  [in tesc[E] units] Time end CRs injection function (number of tesc)
- const int injection_function_norm = 1000
- const double r_snr_thickness = 100

  Constant in order to easily and rapidly normalize the injection function.
- const double electron_injection_rate = 1e-2

  = R_SNR(t)/by the value you chose, it allows to smooth the injection shape of CRs
- const int tesc_model = 1

  Corresponds to the energy injected in the electron spectrum compared to the energy injected in the proton spectrum.
- const int oh_model = 3
- const double eta_gfree = 1
- const double eta_acc = 10
- const double Eknee = 1e15∗eV
- const double alpha = 2.6
- const double coherence_length = 100∗pc
- const double sigma_coherence = 10∗pc

  Coherence length of the magnetic field.
- const double isotropy = 1

4.17.1 Variable Documentation

4.17.1.1 alpha

```
const double alpha = 2.6
```

4.17.1.2 bbeta

```
const double bbeta = 2
```

Actual thermal cond. / the Sptitzer (1962) value.

4.17.1.3 c

```
const double c = 29979245800.
```

e charge in [statC]

4.17.1.4 C06

```
const double C06 = 1.
```

4.17.1.5 coherence_length

```
const double coherence_length = 100*pc
```

4.17.1.6 delta

```
const double delta = 4.
```

Minimum accelered CRs during the Sedov phase.

4.17.1.7 delta_log_output

```
const int delta_log_output = 100
```

Time value of the first output in the logscaled output method.

4.17.1.8 e

```
const double e = 4.80326e-10
```

H2 mass [g].

4.17.1.9 Eknee

```
const double Eknee = 1e15*eV
```

4.17.1.10 electron_injection_rate

```
const double electron_injection_rate = 1e-2
```

= R_SNR(t)/by the value you chose, it allows to smooth the injection shape of CRs

4.17.1.11 Emin

```
const double Emin = 0.1*GeV
```

Factor of the exponential cutoff in the CRs injection spectra (dN(E)/dE $\sim$ exp(-inj_exp_alpha$*$E/E_Max))

4.17.1.12 Esn

```
const double Esn = 1
```

Growth waves saturation rate

- log(0.1)/0.1; Has the form - log(a)/b where b : characteristic max value, a : suppression factor after b, ttau_sat = 0 -> Linear growth This term is still experimental

4.17.1.13 eta_acc

```
const double eta_acc = 10
```

4.17.1.14 eta_gfree

```
const double eta_gfree = 1
```

4.17.1.15 eV

```
const double eV = GeV*1e-9
```

1 TeV in [erg]

4.17.1.16 gam

```
const double gam = 2.2
```

4.17.1.17 GeV

```
const double GeV = 0.00160218
```

1 kpc in [cm]

4.17.1.18 inj_exp_alpha

```
const double inj_exp_alpha = 1
```

Cut-off kind of the CRs injection spectra (0 : Abrupt no smooth, 1 : Exponential_cutoff see. inj_exp_alpha) Note : This model is only applicable to the proton spectrum. For electrons, the injection spectrum will be automatically cut by the synchrotron radiations

4.17.1.19 injection_cutoff

```
const int injection_cutoff = 0
```

CRs injection energy power law index.

4.17.1.20 injection_function_norm

```
const int injection_function_norm = 1000
```

Corresponds approximately to the width of the escape time divided (take care : too high value may affect the calculation and create noise) Max value -> value such as the width of Finj >> dt, max recommended value = 10 for NX,NE = 10, 7

4.17.1.21 injection_function_width

```
const double injection_function_width = 10.
```

[in tesc[E] units] Time end CRs injection function (number of tesc)

4.17.1.22 injection_shape_time

```
const int injection_shape_time = 0
```

From Celli et al. (2019) - see Brahimi et al. (2020)

4.17.1.23 isotropy

```
const double isotropy = 1
```

Width of the transition from the part close to the source where the diffusion coefficient is anitropic and the part far from the source where the diffusion is isotropic

4.17.1.24 kbolz

```
const double kbolz = 1.3807e-16
```

light celerity in [cm/s]

4.17.1.25 km

```
const double km = 1e5
```

1 kyr in [s]

4.17.1.26 kms

```
const double kms = 1e5
```

Boltzmann constant in CGS.

4.17.1.27 kpc

```
const double kpc = 1.e3*pc
```

1 pc in [cm]

4.17.1.28 kyr

```
const double kyr = 1e3*yr
```

1 yr in [s]

4.17.1.29 log_first_data

```
const double log_first_data = 3e-1*kyr
```

Time distribution of output data (0 : linspace, 1 : log10-space 2 : Custom output times, see the function specific↩ OutputData() in the file : out.h)

4.17.1.30 mCII

```
const double mCII = 6*mp + 6*mn
```

HeI mass [g].

4.17.1.31 me

```
const double me = 9.1095e-28
```

Neutron mass [g].

4.17.1.32 Mej

```
const double Mej = 1
```

in units of 1e51 erg : total energy released by SNR

4.17.1.33 MeV

```
const double MeV = 1e-3*GeV
```

1 eV in [erg]

4.17.1.34 mH2

```
const double mH2 = 2*mp
```

CII mass [g].

4.17.1.35 mHeI

```
const double mHeI = 2*mp + 2*mn
```

HII mass [g].

4.17.1.36 mHI

```
const double mHI = mp
```

Electron mass [g].

4.17.1.37 mHII

```
const double mHII = mp
```

HI mass [g].

4.17.1.38 mn

```
const double mn = 1.6749286e-24
```

Proton mass [g].

4.17.1.39 mp

```
const double mp = 1.6726219e-24
```

1 MeV in [erg]

4.17.1.40 nproc

```
const int nproc = 1
```

The way to solve the source terms : 1 -> Exact solutions, 0 -> 1st order numerical solution.

4.17.1.41 number_out_data

```
const int number_out_data = 100
```

200.∗kyr; Instant of the last output data

4.17.1.42 oh_model

```
const int oh_model = 3
```

CR escape time model (1 : All CRs escape at the begining of the radiative phase, 2 : If v_sh $<$ 110 km/s, all CRs escape, 0 : No radiative escape model)

4.17.1.43 output_freq

```
const int output_freq = 0
```

Number of processors for the run (! Still experimental)

4.17.1.44 pc

```
const double pc = 3.086e18
```

1 km in [cm]

4.17.1.45 phi_c

```
const double phi_c = 1
```

For solar abundances.

4.17.1.46 pi

```
const double pi = 3.1472
```

Inclusion of basic mathematic functions.

4.17.1.47 r_snr_thickness

```
const double r_snr_thickness = 100
```

Constant in order to easily and rapidly normalize the injection function.

4.17.1.48 set_background

```
const int set_background = 1
```

Time dilution term according to the SNR shock evolution in the flux tube approx. ie. R_sh^2(t0) P(t0) = R_sh^2(t1) P(t1) if conserved energy Still experimental !!!

4.17.1.49 sig_T

```
const double sig_T = 6.65e-25
```

1 km/s in cm/s

4.17.1.50 sigma_coherence

```
const double sigma_coherence = 10*pc
```

Coherence length of the magnetic field.

4.17.1.51 solver_Dilution

```
const int solver_Dilution = 0
```

Source term effect due to production of self-turbulence - damping applied on backward waves.

4.17.1.52 solver_ImAdvection

```
const int solver_ImAdvection = 1
```

Advective term of the foward waves.

4.17.1.53 solver_ImDampGrowth

```
const int solver_ImDampGrowth = 1
```

Source term effect due to production of self-turbulence - damping applied on foward waves.

4.17.1.54 solver_ImSource1

```
const int solver_ImSource1 = 1
```

Source term effect applied on foward waves due to the dependance of the Alfvén velocity to the space.

4.17.1.55 solver_IpAdvection

```
const int solver_IpAdvection = 1
```

Perpendicular diffusion of e- after the coherence length.

4.17.1.56 solver_IpDampGrowth

```
const int solver_IpDampGrowth = 1
```

Source term effect applied on backward waves due to the dependance of the Alfvén velocity to the space.

4.17.1.57 solver_IpSource1

```
const int solver_IpSource1 = 1
```

Advective term of the backward waves.

4.17.1.58 solver_PcrAdvection

```
const int solver_PcrAdvection = 1
```

[cm^2] Thomson cross section (see Schlickeiser (2002) p.80)

4.17.1.59 solver_PcrAdvection2

```
const int solver_PcrAdvection2 = 1
```

Diffusive term of the CR Pressure.

4.17.1.60 solver_PcrAdvectionE

```
const int solver_PcrAdvectionE = 1
```

Explicit Advection solver for Pcr by the energy derivative of Alfvén velocity.

4.17.1.61 solver_PcrDiffusion

```
const int solver_PcrDiffusion = 1
```

Advective term of the CR Pressure (the classical one -> V_A∗grad ...)

4.17.1.62 solver_PcrPerpDiff

```
const int solver_PcrPerpDiff = 0
```

Source term effect due to the CR injection from the source in the system.

4.17.1.63 solver_PcrSource1

```
const int solver_PcrSource1 = 1
```

Explicit Advection solver for Pcr in energy cdVAdX.

4.17.1.64 solver_PcrSource2

```
const int solver_PcrSource2 = 1
```

Source term effect due to the dependance of the Alfvén velocity to the space.

4.17.1.65 solver_PeAdvection

```
const int solver_PeAdvection = 1
```

Perpendicular diffusion of CRs after the coherence length.

4.17.1.66 solver_PeAdvection2

```
const int solver_PeAdvection2 = 1
```

Diffusive term of the e- Pressure.

4.17.1.67 solver_PeAdvectionE

```
const int solver_PeAdvectionE = 1
```

Explicit Advection solver for e- by the energy derivative of Alfvén velocity.

4.17.1.68 solver_PeAdvectionE1

```
const int solver_PeAdvectionE1 = 1
```

Explicit Advection solver for e- in energy cdVAdX.

4.17.1.69 solver_PeAdvectionE2

```
const int solver_PeAdvectionE2 = 1
```

Sychrotron radiations of e- (looses of energy) - Advection term.

4.17.1.70 solver_PeDiffusion

```
const int solver_PeDiffusion = 1
```

Advective term of the e- Pressure (the classical one -> V_A∗grad ...)

4.17.1.71 solver_PePerpDiff

```
const int solver_PePerpDiff = 0
```

Source term effect due to the e- injection from the source in the system.

4.17.1.72 solver_PeSource1

```
const int solver_PeSource1 = 1
```

Synchrotron radiations of e- (looses of energy) - source term.

4.17.1.73 solver_PeSource2

```
const int solver_PeSource2 = 1
```

Source term effect due to the dependance of the Alfvén velocity to the space (for e-)

4.17.1.74 source_terms_exact

```
const int source_terms_exact = 1
```

Time step of the simulation if only implicit solvers are used and maximum time step value. This timestep has to be $>$ than 10 x min(tesc(E)) Example : If min(tesc) $\sim$ 500 yrs, then dt $<$ 500/10 = 50 yrs

4.17.1.75 step_implicit

```
const double step_implicit = 20.*yr
```

If need to perform some test without background conditions (1 : On, 0 : off)

4.17.1.76 t_data_out_max

```
const double t_data_out_max = 500.*kyr
```

Instant of the first output data.

4.17.1.77 t_data_out_min

```
const double t_data_out_min = 0.*kyr
```

Model of output frequency (0 : n output between t_start and t_end, 1 : 1 output each n timestep) n = number_out↩
_data.

4.17.1.78 t_end_injection

```
const double t_end_injection = 2
```

Time start CRs injection function.

4.17.1.79 t_start_injection

```
const double t_start_injection = 1e-6*kyr
```

0 : Time Dirac CRs, 1 : Time Gaussian CRs

4.17.1.80 tesc_model

```
const int tesc_model = 1
```

Corresponds to the energy injected in the electron spectrum compared to the energy injected in the proton spectrum.

4.17.1.81 TeV

```
const double TeV = 1e3*GeV
```

1 GeV in [erg]

4.17.1.82 time_distrib_of_data

```
const int time_distrib_of_data = 1
```

Total number of output data.

4.17.1.83 Tmax

```
const double Tmax = 500.1*kyr
```

Number of time-step between two LogOutput.

4.17.1.84 ttau_sat

```
const double ttau_sat = - log(0.1)/0.1
```

0 : False, 1 : True -> Show extra informations during the simulation

4.17.1.85 verbose

```
const int verbose = 0
```

200.1*kyr; Define the limit time of your simulation

4.17.1.86 xhi_0

```
const double xhi_0 = 2.026
```

Efficiency of CRs acceleration.

4.17.1.87 xhi_cr

```
const double xhi_cr = 0.1
```

4.17.1.88 xi_n

```
const double xi_n = 1
```

Msun : total mass released by SNR in sun mass units.

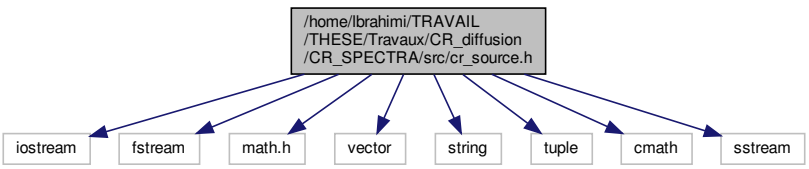
4.17.1.89 yr

```
const double yr = 3.154e+7
```

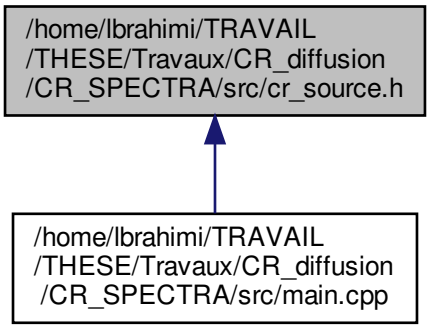
4.18 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/src/cr_source.h File Reference

```
#include <iostream>
#include <fstream>
#include <math.h>
#include <vector>
#include <string>
#include <tuple>
#include <cmath>
#include <sstream>
```

Include dependency graph for cr_source.h:



This graph shows which files directly or indirectly include this file:



Functions

- double GetTSed ()
- double RSNR (double time)
- double u_sh (double time)

  Shock velocity in time.
- double GetEM ()

  Get the EMAX value for the tesc calculation.
- double tesc (double E)
- double B_sat (double time)
- double GetEM_e ()
- double tesc_e (double E)
- double Resc (double E)

  This function return the value of the escape shock radius at a given energy of protons.
- double sigm (double E, double ttesc)

  This function defines the variance of the time injection function Finj of CRs.
- double Finj (double t, double dt, double E, double ttesc)

  CRs time injection function.
- double theta (double z, double t, double Rsnr)

  This function define the spatial shape of the CRs distribution at a given time.
- double dNdE (double E)

  This function defines the injection spectrum of both electrons of protons escaping from the SNR.
- double ff (double E)

  This function defines the distribution function of both electrons and protrons escaping from the SNR.
- double Pcr_ini (double E)

  This function defines the initial pressure distribution of both electrons and protons escaping from the SNR.

Variables

- std::string parameters = "./parameters.dat"
- std::string snx = search(parameters, "NX")
- int nx = stoi(snx)
- std::string sne = search(parameters, "NE")
- int ne = stoi(sne)
- std::string sni = search(parameters,"ni")
- double ni = stod(sni)
- std::string sX = search(parameters,"X")
- double Xi = stod(sX)
- double nt = ni/Xi
- std::string smn = search(parameters,"mn")
- double m_neutral = stod(smn)
- std::string sT = search(parameters,"T")
- double T = stod(sT)
- std::string scenter = search(parameters, "center")
- double x_center = stod(scenter)
- std::string scenter_index = search(parameters, "center_index")
- int x_center_index = stod(scenter_index)
- std::string sBcenter = search(parameters, "B")
- double Bcenter = stod(sBcenter)

4.18.1 Function Documentation

4.18.1.1 B_sat()

```
double B_sat (
            double time )
```

4.18.1.2 dNdE()

```
double dNdE (
            double E )
```

This function defines the injection spectrum of both electrons of protons escaping from the SNR.

4.18.1.3 ff()

```
double ff (
            double E )
```

This function defines the distribution function of both electrons and protrons escaping from the SNR.

4.18.1.4 Finj()

```
double Finj (
             double t,
             double dt,
             double E,
             double ttesc )
```

CRs time injection function.

4.18.1.5 GetEM()

```
double GetEM ( )
```

Get the EMAX value for the tesc calculation.

4.18.1.6 GetEM_e()

```
double GetEM_e ( )
```

This function allows to calculate the maximum energy provided to the electrons escaping from the SNR according to the values in the constans.h file.

4.18.1.7 GetTSed()

```
double GetTSed ( )
```

This function return the value of t_sedov according to the SNR properties specified in the constants.h file

4.18.1.8 Pcr_ini()

```
double Pcr_ini (
             double E )
```

This function defines the initial pressure distribution of both electrons and protons escaping from the SNR.

4.18.1.9 Resc()

```
double Resc (
             double E )
```

This function return the value of the escape shock radius at a given energy of protons.

4.18.1.10 RSNR()

```
double RSNR (
            double time )
```

This function provides the value of the shock radius as a function of the time according to the SNR expansion model from Cioffi et al. 1998 and Truelove & McKee 19... The SNR shock has different propagation stages which are separated by characteristic times defined as below :

$$\begin{aligned} t_{\rm ini,kyr} &= 10^{-4} \\ t_{\rm free,kyr} &= 0.3 E_{\rm SN}^{-1/2} M_{\rm ej} n_t^{-1/3} \\ t_{\rm PDS,yr} &= e^{-1} \times 3.61 \times 10^4 E_{\rm SN}^{3/14} / (\xi_n^{5/14} n_t^{4/7}) \\ t_{\rm MCS,yr} &= \min\left[61 V_{\rm ej,8}^3 / (\xi_n^{9/14} * n_t^{3/7} * E_{\rm SN}^{3/14}), 476 t_{\rm PDS,yr} / (\xi_n \phi_c)^{9/14} \right] \\ t_{\rm merge,yr} &= 153 \left(E_{\rm SN}^{1/14} n_t^{1/7} \xi_n^{3/14} / (\beta C_{06}) \right)^{10/7} t_{\rm PDS,yr} \\ t_{\rm max} &= \max(t_{\rm MCS}, t_{\rm merge}) \end{aligned}$$

where $t_{\rm ini}$ corresponds to the initial time of the numerical computation of the spline, $t_{\rm free}$ correponds to the transition time between the free expansion phase and the Sedov-Taylor phase, $t_{\rm PDS}$ corresponds to the transition time between the Sedov-Taylor phase and the Pressure Driven Snowplow phase, $t_{\rm MCS}$ correponds to the transition time between the Pressure Driven Snowplow phase and the Momentum Conserving Snowplow phase and finally $t_{\rm merge}$ means the time at which the shock pressure becomes of the order of the ISM pressure. In some ISM phases, the shock can merge before entering in the Momentum Conserving Snowplow phase explaining $t_{\rm max}$. The SNR shock evolves with time according the following radii

$$R_{\rm ini} = R_{\rm free}(t_{\rm ini}/t_{\rm free})$$

Parameters

time	Time in [s].

See also

RSNR(), InterpolatingSpline()

4.18.1.11 sigm()

```
double sigm (
            double E,
            double ttesc )
```

This function defines the variance of the time injection function Finj of CRs.

4.18.1.12 tesc()

```
double tesc (
            double E )
```

Protons escape time function according the model of Celli et al. (2019) but also alternatives models of CR escape during radiative stages

4.18.1.13 tesc_e()

```
double tesc_e (
            double E )
```

This function calulate the escape time of the electrons as a function of the energy according both model of escape from Celli et al. (2019) and alternative models of escape in radiative phases

4.18.1.14 theta()

```
double theta (
            double z,
            double t,
            double Rsnr )
```

This function define the spatial shape of the CRs distribution at a given time.

4.18.1.15 u_sh()

```
double u_sh (
            double time )
```

Shock velocity in time.

4.18.2 Variable Documentation

4.18.2.1 Bcenter

```
double Bcenter = stod(sBcenter)
```

4.18.2.2 m_neutral

```
double m_neutral = stod(smn)
```

4.18.2.3 ne

```
int ne = stoi(sne)
```

4.18.2.4 ni

```
double ni = stod(sni)
```

4.18.2.5 nt

```
double nt = ni/Xi
```

4.18.2.6 nx

```
int nx = stoi(snx)
```

4.18.2.7 parameters

```
std::string parameters = "./parameters.dat"
```

4.18.2.8 sBcenter

```
std::string sBcenter = search(parameters, "B")
```

4.18.2.9 scenter

```
std::string scenter = search(parameters, "center")
```

4.18.2.10 scenter_index

```
std::string scenter_index = search(parameters, "center_index")
```

4.18.2.11 smn

```
std::string smn = search(parameters,"mn")
```

4.18.2.12 sne

```
std::string sne = search(parameters, "NE")
```

4.18.2.13 sni

```
std::string sni = search(parameters,"ni")
```

4.18.2.14 snx

```
std::string snx = search(parameters, "NX")
```

4.18.2.15 sT

```
std::string sT = search(parameters,"T")
```

4.18.2.16 sX

```
std::string sX = search(parameters,"X")
```

4.18.2.17 T

```
double T = stod(sT)
```

4.18.2.18 x_center

```
double x_center = stod(scenter)
```

4.18.2.19 x_center_index

```
int x_center_index = stod(scenter_index)
```

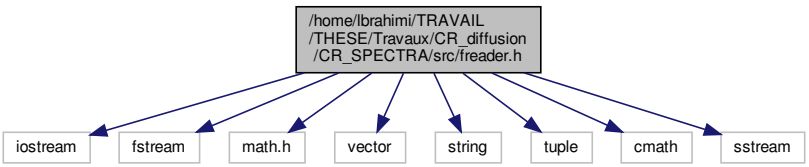
4.18.2.20 Xi

```
double Xi = stod(sX)
```

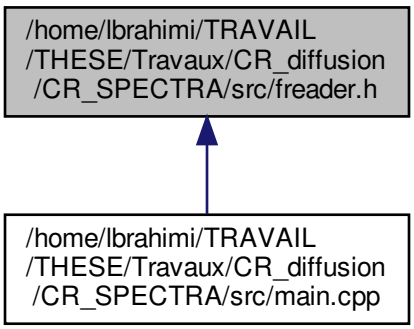
4.19 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/src/freader.h File Reference

```
#include <iostream>
#include <fstream>
#include <math.h>
#include <vector>
#include <string>
#include <tuple>
#include <cmath>
#include <sstream>
```

Include dependency graph for freader.h:



This graph shows which files directly or indirectly include this file:



Functions

- std::string search (string file_name, string variable)
- vector< double > readAxis (std::string filename, int vec_size)

4.19.1 Function Documentation

4.19.1.1 readAxis()

```
vector<double> readAxis (
            std::string filename,
            int vec_size )
```

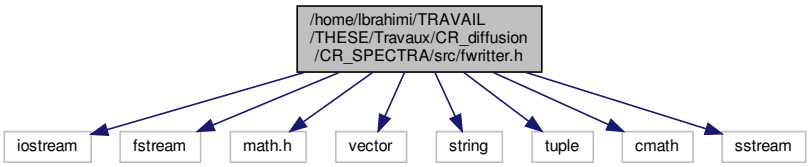
4.19.1.2 search()

```
std::string search (
            string file_name,
            string variable )
```

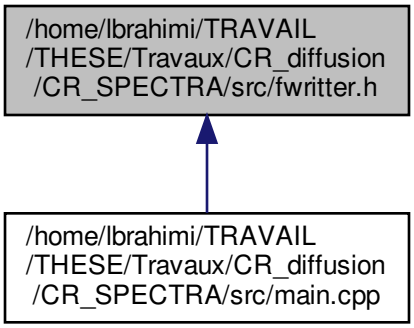
4.20 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/src/fwritter.h File Reference

```
#include <iostream>
#include <fstream>
#include <math.h>
#include <vector>
#include <string>
#include <tuple>
#include <cmath>
#include <sstream>
```

Include dependency graph for fwritter.h:



This graph shows which files directly or indirectly include this file:



Functions

- int writeXE (std::string filename, int index, vector< vector< double > > data, double NX, double NE)
- int writeInfo (std::string filename, int index, vector< double > info, vector< std::string > s_info)

4.20.1 Function Documentation

4.20.1.1 writeInfo()

```
int writeInfo (
            std::string filename,
            int index,
            vector< double > info,
            vector< std::string > s_info )
```

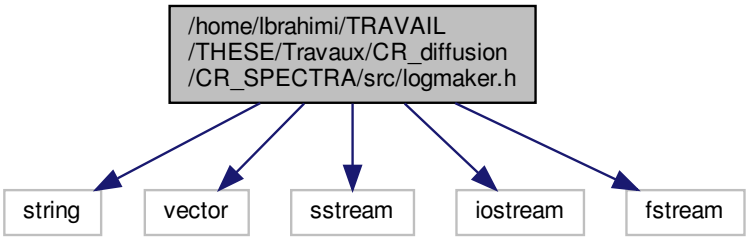
4.20.1.2 writeXE()

```
int writeXE (
            std::string filename,
            int index,
            vector< vector< double > > data,
            double NX,
            double NE )
```

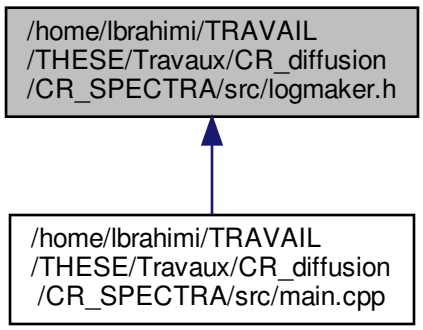
4.21 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/src/logmaker.h File Reference

```
#include <string>
#include <vector>
#include <sstream>
#include <iostream>
#include <fstream>
```

Include dependency graph for logmaker.h:



This graph shows which files directly or indirectly include this file:



Functions

- void showLog_0 (double time, double Tmax, int nstep, int time_id, double duration, double dt)

4.21.1 Function Documentation

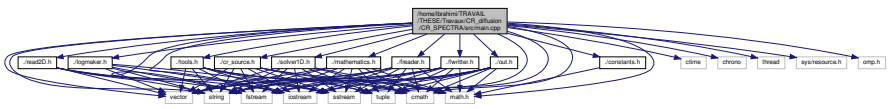
4.21.1.1 showLog_0()

```
void showLog_0 (
            double time,
            double Tmax,
            int nstep,
            int time_id,
            double duration,
            double dt )
```

4.22 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/src/main.cpp File Reference

```
#include <iostream>
#include <fstream>
#include <math.h>
#include <vector>
#include <string>
#include <tuple>
#include <cmath>
#include <sstream>
#include <ctime>
#include <chrono>
#include <thread>
#include <sys/resource.h>
#include <omp.h>
#include "./mathematics.h"
#include "./constants.h"
#include "./read2D.h"
#include "./freader.h"
#include "./fwritter.h"
#include "./out.h"
#include "./logmaker.h"
#include "./tools.h"
#include "./cr_source.h"
#include "./solver1D.h"
```

Include dependency graph for main.cpp:



Functions

- int main ()

4.22.1 Function Documentation

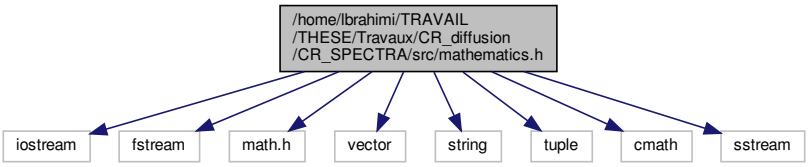
4.22.1.1 main()

```
int main ( )
```

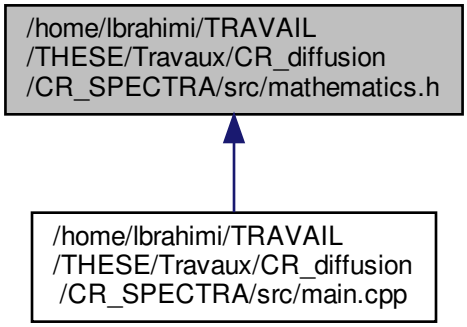
4.23 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/src/mathematics.h File Reference

```
#include <iostream>
#include <fstream>
#include <math.h>
#include <vector>
#include <string>
#include <tuple>
#include <cmath>
#include <sstream>
```

Include dependency graph for mathematics.h:



This graph shows which files directly or indirectly include this file:



Functions

- vector< double > TDMA (vector< double > a, vector< double > b, vector< double > c, vector< double > d)

- void InverseTrigonalMatrix (vector< vector< double > > &T)
- void ProductMatrix (vector< vector< double > > A, vector< vector< double > > B, vector< vector< double > > &C)
- double InterpolatingSpline (vector< double > X, vector< double > Y, double x)
- double f1 (double x, vector< double > cst)
- double df1dx (double x, vector< double > cst)
- double f2 (double x, vector< double > cst)
- double df2dx (double x, vector< double > cst)
- double NewtonRaphson (double f(double, vector< double >), double df(double, vector< double >), double x0, double eps, vector< double > cst)
- double GetMax (vector< double > V)
- void transpose (vector< vector< double > > &b, vector< vector< double > > &c)
- double minmod (double a, double b)

4.23.1 Function Documentation

4.23.1.1 df1dx()

```
double df1dx (
            double x,
            vector< double > cst )
```

4.23.1.2 df2dx()

```
double df2dx (
            double x,
            vector< double > cst )
```

4.23.1.3 f1()

```
double f1 (
            double x,
            vector< double > cst )
```

4.23.1.4 f2()

```
double f2 (
            double x,
            vector< double > cst )
```

4.23.1.5 GetMax()

```
double GetMax (
            vector< double > V )
```

4.23.1.6 InterpolatingSpline()

```
double InterpolatingSpline (
            vector< double > X,
            vector< double > Y,
            double x )
```

4.23.1.7 InverseTrigonalMatrix()

```
void InverseTrigonalMatrix (
            vector< vector< double > > & T )
```

4.23.1.8 minmod()

```
double minmod (
            double a,
            double b )
```

4.23.1.9 NewtonRaphson()

```
double NewtonRaphson (
            double  fdouble, vector< double >,
            double  dfdouble, vector< double >,
            double x0,
            double eps,
            vector< double > cst )
```

4.23.1.10 ProductMatrix()

```
void ProductMatrix (
            vector< vector< double > > A,
            vector< vector< double > > B,
            vector< vector< double > > & C )
```

4.23.1.11 TDMA()

```
vector<double> TDMA (
            vector< double > a,
            vector< double > b,
            vector< double > c,
            vector< double > d )
```

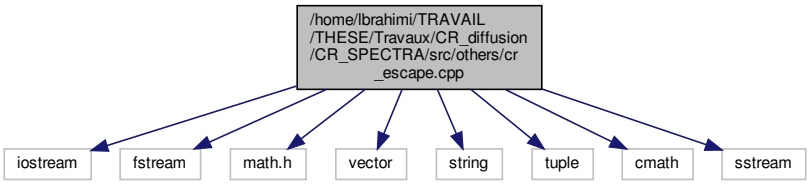
4.23.1.12 transpose()

```
void transpose (
            vector< vector< double > > & b,
            vector< vector< double > > & c )
```

4.24 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/src/others/cr_escape.cpp File Reference

```
#include <iostream>
#include <fstream>
#include <math.h>
#include <vector>
#include <string>
#include <tuple>
#include <cmath>
#include <sstream>
```

Include dependency graph for cr_escape.cpp:



Functions

- void InverseTrigonalMatrix (vector< vector< double > > &T)
- void ProductMatrix (vector< vector< double > > A, vector< vector< double > > B, vector< vector< double > > &C)
- double InterpolatingSpline (vector< double > X, vector< double > Y, double x)
- double f1 (double x, vector< double > cst)
- double df1dx (double x, vector< double > cst)
- double f2 (double x, vector< double > cst)
- double df2dx (double x, vector< double > cst)
- double NewtonRaphson (double f(double, vector< double >), double df(double, vector< double >), double x0, double eps, vector< double > cst)
- double GetMax (vector< double > V)
- double GetTesc (double E, double delta, vector< double > cst)
- int main ()

4.24.1 Function Documentation

4.24.1.1 df1dx()

```
double df1dx (
            double x,
            vector< double > cst )
```

4.24.1.2 df2dx()

```
double df2dx (
            double x,
            vector< double > cst )
```

4.24.1.3 f1()

```
double f1 (
            double x,
            vector< double > cst )
```

4.24.1.4 f2()

```
double f2 (
            double x,
            vector< double > cst )
```

4.24.1.5 GetMax()

```
double GetMax (
            vector< double > V )
```

4.24.1.6 GetTesc()

```
double GetTesc (
            double E,
            double delta,
            vector< double > cst )
```

4.24.1.7 InterpolatingSpline()

```
double InterpolatingSpline (
            vector< double > X,
            vector< double > Y,
            double x )
```

4.24.1.8 InverseTrigonalMatrix()

```
void InverseTrigonalMatrix (
            vector< vector< double > > & T )
```

4.24.1.9 main()

```
int main ( )
```

4.24.1.10 NewtonRaphson()

```
double NewtonRaphson (
            double  fdouble, vector< double >,
            double  dfdouble, vector< double >,
            double x0,
            double eps,
            vector< double > cst )
```

4.24.1.11 ProductMatrix()

```
void ProductMatrix (
            vector< vector< double > > A,
            vector< vector< double > > B,
            vector< vector< double > > & C )
```

4.25 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/src/others/PDE_solvers.py File Reference

Namespaces

- PDE_solvers

Functions

- def PDE_solvers.TDMA (a, b, c, d)
- def PDE_solvers.A (x)
- def PDE_solvers.B (x)
- def PDE_solvers.C (x)
- def PDE_solvers.Q (x)
- def PDE_solvers.T (x)
- def PDE_solvers.finiteDiffSolver (dt, Tmax, u)
- def PDE_solvers.SimpleImplicitSolver (dt, Tmax, u)
- def PDE_solvers.CC70Solver (dt, Tmax, u)

Variables

- float PDE_solvers.pc = 3.086e18

  Tri Diagonal Matrix Algorithm(a.k.a Thomas algorithm) solver def TDMAsolver(a, b, c, d): ''' TDMA solver, a b c d can be NumPy array type or Python list type.
- float PDE_solvers.yr = 365.25∗86400
- int PDE_solvers.kyr = 1e3∗yr
- int PDE_solvers.M = 2048
- int PDE_solvers.Xmin = 0.
- int PDE_solvers.Xmax = 1000.∗pc
- PDE_solvers.X = np.linspace(Xmin, Xmax, M+1)
- PDE_solvers.u = np.zeros(M+1)

  plt.semilogy(X/pc, u, c="blue") plt.plot(X/pc, u/U, c="red") plt.axhline(1.) print ("ratio = ",sum(u)/sum(U))
- PDE_solvers.u0 = u[1]
- PDE_solvers.uM = u[M-1]
- PDE_solvers.u_ini = u.copy()
- PDE_solvers.u_end = u
- int PDE_solvers.Tmax = 10.∗kyr
- def PDE_solvers.u_0 = CC70Solver(0.1∗kyr, Tmax, u)
- def PDE_solvers.u_1 = CC70Solver(0.5∗kyr, Tmax, u)
- def PDE_solvers.u_2 = CC70Solver(5.∗kyr, Tmax, u)
- PDE_solvers.figsize
- PDE_solvers.c

4.26 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/src/others/Split_solvers.py File Reference

Namespaces

- Split_solvers

Functions

- def Split_solvers.TDMA (a, b, c, d)
- def Split_solvers.generalized_diffusion (u, X, D, dt, theta=0.5)

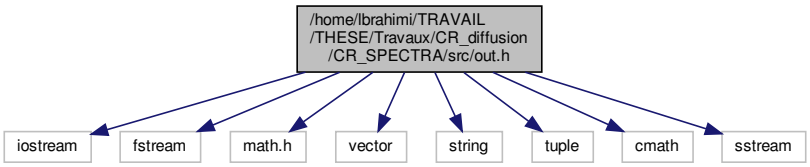
Variables

- int Split_solvers.NX = 1000
- int Split_solvers.Xmin = -1
- int Split_solvers.Xmax = 1
- Split_solvers.X = np.linspace(Xmin, Xmax, NX+1)
- int Split_solvers.D = np.ones(len(X))∗1e-2
- int Split_solvers.u = np.ones(len(X))∗0.
- Split_solvers.c
- int Split_solvers.t_ini = 0.
- int Split_solvers.dt = 1e-1
- int Split_solvers.t_max = 1.
- int Split_solvers.t = t_ini
- int Split_solvers.u_new_0 = u
- int Split_solvers.u_old = u_new_0
- int Split_solvers.u_new_1 = u

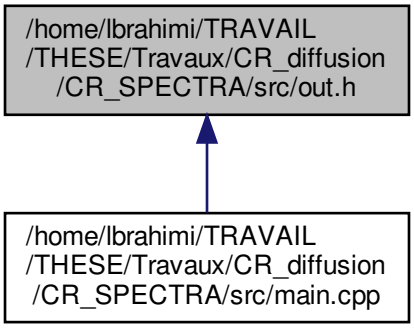
4.27 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/src/out.h File Reference

```
#include <iostream>
#include <fstream>
#include <math.h>
#include <vector>
#include <string>
#include <tuple>
#include <cmath>
#include <sstream>
```

Include dependency graph for out.h:



This graph shows which files directly or indirectly include this file:



Functions

- vector< double > specificOutputData ()
- vector< double > outputData (double tmin, double tmax, int nvalues, string modulation, double eps)

  Output data function for a regular and large amount of output data.
- vector< double > getOutput ()

  Main output file function. This one will be used in the main file.
- int getLogOutput ()

  Main output log file function. This one will be used in the main file.
- double setTmax ()

  Define the limit time of your simulation.

4.27.1 Function Documentation

4.27.1.1 getLogOutput()

```
int getLogOutput ( )
```

Main output log file function. This one will be used in the main file.

4.27.1.2 getOutput()

```
vector<double> getOutput ( )
```

Main output file function. This one will be used in the main file.

4.27.1.3 outputData()

```
vector<double> outputData (
            double tmin,
            double tmax,
            int nvalues,
            string modulation,
            double eps )
```

Output data function for a regular and large amount of output data.

4.27.1.4 setTmax()

```
double setTmax ( )
```

Define the limit time of your simulation.

4.27.1.5 specificOutputData()

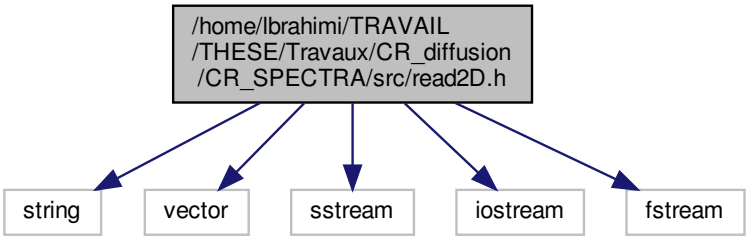
```
vector<double> specificOutputData ( )
```

This function allows you to specify your own data output time array You just need to fill the list loc_data, example: double loc_data[] = {t1, t2, ..., tn}; where t_i is in seconds

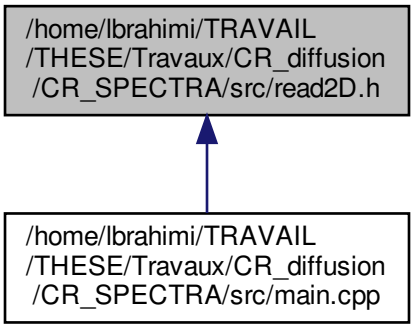
4.28 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/src/read2D.h File Reference

```
#include <string>
#include <vector>
#include <sstream>
#include <iostream>
#include <fstream>
```

Include dependency graph for read2D.h:



This graph shows which files directly or indirectly include this file:



Functions

- vector< vector< double > > parse2DCsvFile (string inputFileName, int start)

4.28.1 Function Documentation

4.28.1.1 parse2DCsvFile()

```
vector<vector<double> > parse2DCsvFile (
            string inputFileName,
            int start )
```

Reads csv file into table, exported as a vector of vector of doubles.

Parameters

inputFileName	input file name (full path).

Returns

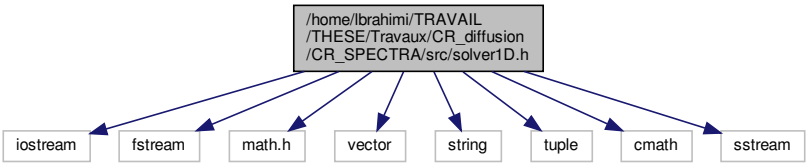
data as vector of vector of doubles.

4.29 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/src/solver1D.h File Reference

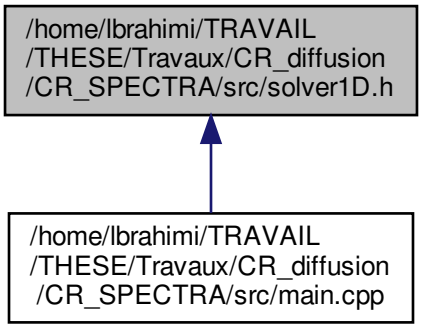
```
#include <iostream>
#include <fstream>
```

```
#include <math.h>
#include <vector>
#include <string>
#include <tuple>
#include <cmath>
#include <sstream>
```

Include dependency graph for solver1D.h:



This graph shows which files directly or indirectly include this file:



Functions

- void thetaDiffusionSolver (vector< vector< double > > &u, vector< vector< double > > &Pcr_new, double dt, vector< double > X, int NE, vector< vector< double > > Ip, vector< vector< double > > Im, vector< vector< double > > Db, vector< vector< double > > &Pcr_background)
- void advectionSolverX (vector< vector< double > > &u_old, vector< vector< double > > &u_new, double dt, vector< double > X, int NE, vector< vector< double > > V, int sign, int border)
- void advectionSolverE (vector< vector< double > > &u_old, vector< vector< double > > &u_new, double dt, vector< double > E, int NX, vector< vector< double > > V, vector< vector< double > > u_background)
- void advectionSolverE1 (vector< vector< double > > &u_old, vector< vector< double > > &u_new, double dt, vector< double > E, vector< double > BB, vector< double > EE, int NX, vector< vector< double > > u_background)
- void advectionSolverE2 (vector< vector< double > > &u_old, vector< vector< double > > &u_new, double dt, vector< double > E, int NX, vector< double > BB, vector< double > EE, vector< vector< double > > u_background)

- void sourceSolver (vector< vector< double > > &u_old, vector< vector< double > > &u_new, double dt, vector< vector< double > > source, double factor)
- void sourceGrowthDampRateSolver (vector< vector< double > > &u_old, vector< vector< double > > &u_new, vector< vector< double > > v_old, vector< vector< double > > source, vector< vector< double > > background, vector< double > X, double dt, vector< vector< double > > V, vector< double > B, int factor)
- void CRsInjectionSourceSolver (vector< vector< double > > &u_old, vector< vector< double > > &u_new, double dt, vector< double > Pcr_ini, vector< double > Finj_temp, vector< double > vec_theta)
- void dilute_solver (vector< vector< double > > &u_old, vector< vector< double > > &u_new, vector< vector< double > > u_background, double r_new, double r_old, vector< double > nn, vector< double > ni, vector< double > mn, vector< double > mi, vector< double > B, vector< double > T)
- void perpendicular_diffusion_solver (vector< vector< double > > &u_old, vector< vector< double > > &u_new, vector< vector< double > > u_bc, vector< vector< double > > Db, vector< vector< double > > I0, vector< double > X, double dt, vector< double > r_esc)
- void NotMove (vector< vector< double > > u, vector< vector< double > > u_new)
- void electron_source (vector< vector< double > > &u_old, vector< vector< double > > &u_new, vector< double > E, double dt, int NE, int NX, vector< vector< double > > u_background)

4.29.1 Function Documentation

4.29.1.1 advectionSolverE()

```
void advectionSolverE (
            vector< vector< double > > & u_old,
            vector< vector< double > > & u_new,
            double dt,
            vector< double > E,
            int NX,
            vector< vector< double > > V,
            vector< vector< double > > u_background )
```

4.29.1.2 advectionSolverE1()

```
void advectionSolverE1 (
            vector< vector< double > > & u_old,
            vector< vector< double > > & u_new,
            double dt,
            vector< double > E,
            vector< double > BB,
            vector< double > EE,
            int NX,
            vector< vector< double > > u_background )
```

4.29.1.3 advectionSolverE2()

```
void advectionSolverE2 (
            vector< vector< double > > & u_old,
            vector< vector< double > > & u_new,
            double dt,
            vector< double > E,
            int NX,
            vector< double > BB,
            vector< double > EE,
            vector< vector< double > > u_background )
```

4.29.1.4 advectionSolverX()

```
void advectionSolverX (
            vector< vector< double > > & u_old,
            vector< vector< double > > & u_new,
            double dt,
            vector< double > X,
            int NE,
            vector< vector< double > > V,
            int sign,
            int border )
```

4.29.1.5 CRsInjectionSourceSolver()

```
void CRsInjectionSourceSolver (
            vector< vector< double > > & u_old,
            vector< vector< double > > & u_new,
            double dt,
            vector< double > Pcr_ini,
            vector< double > Finj_temp,
            vector< double > vec_theta )
```

4.29.1.6 dilute_solver()

```
void dilute_solver (
            vector< vector< double > > & u_old,
            vector< vector< double > > & u_new,
            vector< vector< double > > u_background,
            double r_new,
            double r_old,
            vector< double > nn,
            vector< double > ni,
            vector< double > mn,
            vector< double > mi,
            vector< double > B,
            vector< double > T )
```

4.29.1.7 electron_source()

```
void electron_source (
            vector< vector< double > > & u_old,
            vector< vector< double > > & u_new,
            vector< double > E,
            double dt,
            int NE,
            int NX,
            vector< vector< double > > u_background )
```

4.29.1.8 NotMove()

```
void NotMove (
            vector< vector< double > > u,
            vector< vector< double > > u_new )
```

4.29.1.9 perpendicular_diffusion_solver()

```
void perpendicular_diffusion_solver (
            vector< vector< double > > & u_old,
            vector< vector< double > > & u_new,
            vector< vector< double > > u_bc,
            vector< vector< double > > Db,
            vector< vector< double > > I0,
            vector< double > X,
            double dt,
            vector< double > r_esc )
```

4.29.1.10 sourceGrowthDampRateSolver()

```
void sourceGrowthDampRateSolver (
            vector< vector< double > > & u_old,
            vector< vector< double > > & u_new,
            vector< vector< double > > v_old,
            vector< vector< double > > source,
            vector< vector< double > > background,
            vector< double > X,
            double dt,
            vector< vector< double > > V,
            vector< double > B,
            int factor )
```

4.29.1.11 sourceSolver()

```
void sourceSolver (
            vector< vector< double > > & u_old,
            vector< vector< double > > & u_new,
            double dt,
            vector< vector< double > > source,
            double factor )
```

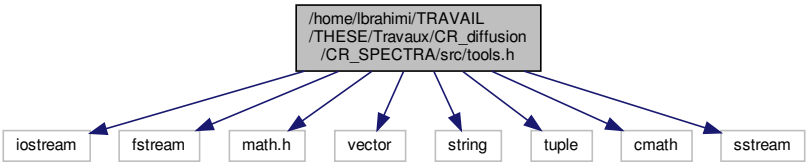
4.29.1.12 thetaDiffusionSolver()

```
void thetaDiffusionSolver (
            vector< vector< double > > & u,
            vector< vector< double > > & Pcr_new,
            double dt,
            vector< double > X,
            int NE,
            vector< vector< double > > Ip,
            vector< vector< double > > Im,
            vector< vector< double > > Db,
            vector< vector< double > > & Pcr_background )
```

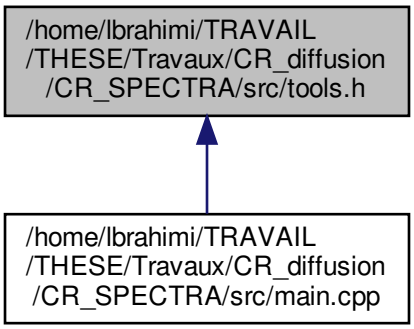
4.30 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/src/tools.h File Reference

```
#include <iostream>
#include <fstream>
#include <math.h>
#include <vector>
#include <string>
#include <tuple>
#include <cmath>
#include <sstream>
```

Include dependency graph for tools.h:



This graph shows which files directly or indirectly include this file:



Functions

- double maxElement1D (vector< double > data)
- double minElement1D (vector< double > data)
- double maxElement2D (vector< vector< double > > data)
- double minElement2D (vector< vector< double > > data)
- double absmaxElement2D (vector< vector< double > > data)

4.30.1 Function Documentation

4.30.1.1 absmaxElement2D()

```
double absmaxElement2D (
            vector< vector< double > > data )
```

4.30.1.2 maxElement1D()

```
double maxElement1D (
            vector< double > data )
```

4.30.1.3 maxElement2D()

```
double maxElement2D (
            vector< vector< double > > data )
```

4.30.1.4 minElement1D()

```
double minElement1D (
            vector< double > data )
```

4.30.1.5 minElement2D()

```
double minElement2D (
            vector< vector< double > > data )
```

4.31 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/background↩ _diffusion_coefficient.py File Reference

Namespaces

- background_diffusion_coefficient

Functions

- def background_diffusion_coefficient.IonNeutral_Damping (k, medium_props, nu_n=0, theta=0)
- def background_diffusion_coefficient.Duu_Alfven_Slab_Linear_Undamped (mu, E, medium_props, mass=cst.mp, kmin=1e-20, q=1.5, l=1e-4)
- def background_diffusion_coefficient.Kappa_zz (E, medium_props, mass=cst.mp, kmin=(50.∗cst.pc) ∗∗(-1), q=5./3, l=1e-4)

4.32 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/show↩ _models/obsolette/background_diffusion_coefficient.py File Reference

Namespaces

- background_diffusion_coefficient

Functions

- def background_diffusion_coefficient.J (a, b, c, D, q, x)

Variables

- background_diffusion_coefficient.phase = ism.CNM
- background_diffusion_coefficient.B0 = phase.get('B')
- background_diffusion_coefficient.mi = phase.get("mi")
- background_diffusion_coefficient.mn = phase.get("mn")
- background_diffusion_coefficient.ni = phase.get("ni")
- background_diffusion_coefficient.nn = phase.get("nn")
- background_diffusion_coefficient.T = phase.get("T")
- tuple background_diffusion_coefficient.chi = (mn∗nn)/(mi∗ni)
- background_diffusion_coefficient.VAi = B0/np.sqrt(4∗np.pi∗mi∗ni)
- background_diffusion_coefficient.VA = B0/np.sqrt(4∗np.pi∗(mi∗ni + mn∗nn))
- int background_diffusion_coefficient.nu_in = 2∗nn∗8.4e-9∗(50/1e4)∗∗0.4
- tuple background_diffusion_coefficient.nu_ni = chi∗∗(-1.)∗nu_in
- int background_diffusion_coefficient.k_min = 1e-20
- int background_diffusion_coefficient.k_cm = 1e-15
- int background_diffusion_coefficient.k_cp = 1e-20
- int background_diffusion_coefficient.k_max = 2∗nu_ni/VA
- int background_diffusion_coefficient.E = 10∗cst.GeV
- background_diffusion_coefficient.m = cst.mp
- int background_diffusion_coefficient.gamma = 1 + (E /(m∗cst.c∗∗2))
- background_diffusion_coefficient.v = cst.c∗np.sqrt(1 - (1/(E/(m∗cst.c∗∗2) + 1))∗∗2)
- int background_diffusion_coefficient.p = gamma∗m∗v
- background_diffusion_coefficient.Omega0 = cst.e∗B0/(m∗cst.c)
- int background_diffusion_coefficient.Omega = Omega0/gamma
- background_diffusion_coefficient.mu = np.linspace(-0.99, 0.99, 100)
- background_diffusion_coefficient.d_uu = np.zeros(len(mu))
- int background_diffusion_coefficient.k_zz = 0.
- background_diffusion_coefficient.dmu = mu[1] - mu[0]
- int background_diffusion_coefficient.ltot = 1e-1
- float background_diffusion_coefficient.q = 1.5
- tuple background_diffusion_coefficient.a = (v∗mu[ii] - VA)∗∗2
- int background_diffusion_coefficient.b = 2∗Omega∗(v∗mu[ii] - VA)
- int background_diffusion_coefficient.c = Omega∗∗2 + (- nu_in/2)∗∗2
- int background_diffusion_coefficient.D = b∗∗2 - 4∗a∗c
- background_diffusion_coefficient.eps = VA/v
- int background_diffusion_coefficient.gs0 = 2∗(q-1)∗(B0∗∗2/(8∗np.pi))∗ltot∗k_cp∗∗(q - 1)
- def background_diffusion_coefficient.fj_p = J(a, b, c, D, q, k_max) - J(a, b, c, D, q, k_cp)
- def background_diffusion_coefficient.fj_m = J(a, -b, c, D, q, k_max) - J(a, -b, c, D, q, k_cp)
- int background_diffusion_coefficient.I = -2∗gs0∗(1 - mu[ii]∗eps)∗∗2∗(- nu_in/2.)∗fj_p

4.33 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/constants.py File Reference

Namespaces

- constants

Variables

- float constants.yr = 3.154e+7
- int constants.kyr = 1e3∗yr
- float constants.pc = 3.086e18
- int constants.kpc = 1.e3∗pc
- float constants.GeV = 0.00160218
- int constants.TeV = 1e3∗GeV
- float constants.eV = GeV∗1e-9
- int constants.MeV = 1e-3∗GeV
- float constants.me = 9.10938e-28
- float constants.mp = 1.6726219e-24
- float constants.mn = 1.6749286e-24
- float constants.mHI = mp
- float constants.mHII = mp
- int constants.mHeI = 2∗mp + 2∗mn
- int constants.mHeII = 2∗mp + 2∗mn
- int constants.mCII = 6∗mp + 6∗mn
- int constants.mHCOII = 8∗mp + 8∗mn + 6∗mp + 6∗mn + mp + mn
- int constants.mH2 = 2∗mp
- float constants.e = 4.80326e-10
- int constants.c = 29979245800.
- float constants.kbolz = 1.3807e-16
- int constants.kms = 1e5

4.34 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/d1_↩ grid_generator.py File Reference

Namespaces

- d1_grid_generator

Functions

- def d1_grid_generator.grid (Smin, Smax, Ns, name, s_center=None, width=None, smooth=None, d↩ Xmin=0.01 ∗cst.pc)

4.35 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/damping.py File Reference

Namespaces

- damping

Functions

- def damping.IN_damping_approx_2 (E, medium_props, theta=0)
- def damping.IN_damping_approx_1 (E, medium_props, nu_n=0, theta=0)
- def damping.IonNeutral_Damping (E, medium_props, nu_n=0, theta=0)
- def damping.indamping_alfven (position_index, E, medium_props)
- def damping.indamping_alfven_nopos (E, medium_props)
- def damping.damping_lazarian (position_index, E, medium_props)
- def damping.damping_lazarian_nopos (E, medium_props)
- def damping.non_linear_landau_damping (T, Ip, Im, mi, q, B0, Ecr)

4.36 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/Data_reader.py File Reference

Namespaces

- Data_reader

Functions

- def Data_reader.readDataXE (file_name, NX, NE)
- def Data_reader.readAxis (file_name)

Variables

- def Data_reader.data = readDataXE("../data_out/Pcr_0165.dat", 2**11, 2**5)
- def Data_reader.X = readAxis("../data_ini/X.dat")
- def Data_reader.E = readAxis("../data_ini/E.dat")
- Data_reader.figsize

4.37 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/freader.py File Reference

Namespaces

- freader

Functions

- def freader.search (file_name, variable)

4.38 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/fwritter.py File Reference

Namespaces

- fwritter

Functions

- def fwritter.search (file_name, variable)
- def fwritter.fileWrite (file_name, variables={}, path='./', ext='.dat')
- def fwritter.write1D (file_name, nx=None, ne=None, variable=None, path="./")
- def fwritter.write2D (file_name, nx=None, ny=None, ne=None, variable=None, path="./")
- def fwritter.write1Daxis (file_name, variable=None, nx=None, path="./")

4.39 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/gaussian_subNormalization.py File Reference

Namespaces

- gaussian_subNormalization

Functions

- def gaussian_subNormalization.gauss (t, sig, mu)

Variables

- float gaussian_subNormalization.tmin = 0.01
- float gaussian_subNormalization.tesc = 25.23
- int gaussian_subNormalization.tmax = 2*tesc - tmin
- int gaussian_subNormalization.sig = 2
- int gaussian_subNormalization.mu = 25
- int gaussian_subNormalization.Nc = 1e6
- gaussian_subNormalization.tc = np.linspace(tmin, tmax, Nc)
- int gaussian_subNormalization.Nv = 100
- gaussian_subNormalization.ta = np.linspace(tmin, tmax, Nv)
- int gaussian_subNormalization.r = Nc/Nv
- gaussian_subNormalization.gauss_c = np.zeros(len(tc))
- gaussian_subNormalization.gauss_a = np.zeros(len(ta))
- int gaussian_subNormalization.C_c = 0.
- int gaussian_subNormalization.C_a = 0.
- gaussian_subNormalization.color
- gaussian_subNormalization.c

4.40 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/mathmethods.py File Reference

Namespaces

- mathmethods

Functions

- def mathmethods.Cubic3 (a, b, c, d)
- def mathmethods.findF (a, b, c)
- def mathmethods.findG (a, b, c, d)
- def mathmethods.findH (g, f)
- def mathmethods.cardano3 (a, b, c)
- def mathmethods.histogram (data, xi, xf, nbin, scale, normalization)
- def mathmethods.g (f, t)
- def mathmethods.simpson_log (f, a, b, N)
- def mathmethods.glin (f, t)
- def mathmethods.simpson_lin (f, a, b, N)
- def mathmethods.g1 (x, xt, l)
- def mathmethods.g2 (x, xt, l)
- def mathmethods.f (x, xt, l, v1, v2)
- def mathmethods.shape (X, Amp, Xmin=0., Xmax=1., sig_Xmin=0.1, sig_Xmax=0.2)
- def mathmethods.multishape (X, Amp, Xmin, Xmax, sig)
- def mathmethods.SmoothPhaseTransition (X, E, phases, smooth_width)

4.41 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/Output_functions.py File Reference

Namespaces

- Output_functions

4.42 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/phases_collection.py File Reference

Namespaces

- phases_collection

Functions

- def phases_collection.ism_phase (Temp, Bfiel, nion, ntot, mion, mneutral)

Variables

- def phases_collection.HII = ism_phase(8000, 10.e-6, 99.9, 100., 0.93∗cst.mHII+0.07∗cst.mHeII, 0.93∗cst.mHI+0.07∗cst.mHeI)
- def phases_collection.WIM = ism_phase(8000, 5.00001e-6, 0.315, 0.35, cst.mHII, 0.93∗cst.mHI+0.07∗cst.mHeI)
- def phases_collection.WNM = ism_phase(8000, 5.00001e-6, 7e-3, 0.35, cst.mHII, 0.93∗cst.mHI+0.07∗cst.mHeI)
- def phases_collection.CNM = ism_phase(50, 6.00001e-6, 2.3e-2, 30.0, cst.mCII, 0.93∗cst.mHI+0.07∗cst.mHeI)
- def phases_collection.DiM = ism_phase(50, 6.00001e-6, 3.0e-2, 300, cst.mCII, 0.93∗(0.5∗cst.mHI + 0.5∗cst.mH2) + 0.07∗cst.mHeI)
- def phases_collection.DeM = ism_phase(30, 26.0001e-6, 3.0e-2, 3000, cst.mHCOII, 0.93∗cst.mH2 + 0.07∗cst.mHeI)
- def phases_collection.DeC = ism_phase(20, 59.0001e-6, 1.0e-2, 1e4, cst.mHCOII, 0.93∗cst.mH2 + 0.07∗cst.mHeI)

4.43 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/physical_models.py File Reference

Namespaces

- physical_models

Functions

- def physical_models.collision_rate (specie1, specie2, phase)
- def physical_models.cr_escape_time_model (option, model, Ecr, props)
- def physical_models.cr_escape_radius_model (option, model, time, props)

4.44 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/show_models/background_diffusion_coefficient_3.py File Reference

Namespaces

- background_diffusion_coefficient_3

Functions

- def background_diffusion_coefficient_3.IonNeutral_Damping (k, medium_props, nu_n=0, theta=0)
- def background_diffusion_coefficient_3.Duu_Alfven_Slab_Linear_Undamped (mu, E, medium_props, mass=cst.mp, kmin=1e-20, q=1.5, l=1e-4)
- def background_diffusion_coefficient_3.Kappa_zz (E, medium_props, mass=cst.mp, kmin=1e-20, q=5./3, l=1e28)
- def background_diffusion_coefficient_3.kappa_zz_BC (E, d00, delta)

Variables

- float background_diffusion_coefficient_3.Emin = 0.1∗cst.GeV
- int background_diffusion_coefficient_3.Emax = 100∗cst.TeV
- background_diffusion_coefficient_3.E = np.logspace(np.log10(Emin), np.log10(Emax), 100)
- background_diffusion_coefficient_3.K_zz_bc_1 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_bc_2 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_1 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_2 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_HII_1 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_WIM_1 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_WNM_1 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_CNM_1 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_DiM_1 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_DeM_1 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_DeC_1 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_HII_2 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_WIM_2 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_WNM_2 = np.zeros(len(E))

- background_diffusion_coefficient_3.K_zz_CNM_2 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_DiM_2 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_DeM_2 = np.zeros(len(E))
- background_diffusion_coefficient_3.K_zz_DeC_2 = np.zeros(len(E))
- background_diffusion_coefficient_3.HII
- background_diffusion_coefficient_3.mass
- background_diffusion_coefficient_3.mp
- background_diffusion_coefficient_3.kmin
- background_diffusion_coefficient_3.q
- background_diffusion_coefficient_3.I
- background_diffusion_coefficient_3.WIM
- background_diffusion_coefficient_3.WNM
- background_diffusion_coefficient_3.CNM
- background_diffusion_coefficient_3.DiM
- background_diffusion_coefficient_3.DeM
- background_diffusion_coefficient_3.DeC
- int background_diffusion_coefficient_3.size_x = 4
- int background_diffusion_coefficient_3.size_y = 3
- int background_diffusion_coefficient_3.sub_x = 2
- int background_diffusion_coefficient_3.sub_y = 2
- background_diffusion_coefficient_3.fig = plt.figure(figsize=(size_x∗sub_x,size_y∗sub_y))
- background_diffusion_coefficient_3.gs = gridspec.GridSpec(ncols= sub_x, nrows = sub_y, figure = fig)
- background_diffusion_coefficient_3.wspace
- background_diffusion_coefficient_3.hspace
- background_diffusion_coefficient_3.ax0 = fig.add_subplot(gs[0, 0])
- background_diffusion_coefficient_3.GeV
- background_diffusion_coefficient_3.c
- background_diffusion_coefficient_3.ls
- background_diffusion_coefficient_3.facecolor
- background_diffusion_coefficient_3.alpha
- background_diffusion_coefficient_3.hatch
- background_diffusion_coefficient_3.label
- background_diffusion_coefficient_3.loc
- background_diffusion_coefficient_3.ax1 = fig.add_subplot(gs[0, 1])
- background_diffusion_coefficient_3.ax2 = fig.add_subplot(gs[1, 0])
- background_diffusion_coefficient_3.ax3 = fig.add_subplot(gs[1, 1])
- list background_diffusion_coefficient_3.custom_lines
- background_diffusion_coefficient_3.handles
- background_diffusion_coefficient_3.bbox_to_anchor
- background_diffusion_coefficient_3.ncol
- int background_diffusion_coefficient_3.ymin = 1e27
- int background_diffusion_coefficient_3.ymax = 1e33
- int background_diffusion_coefficient_3.xmin = 1e-1
- int background_diffusion_coefficient_3.xmax = 1e5

4.45 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/show_models/damping_models.py File Reference

Namespaces

- damping_models

Functions

- def damping_models.damprate_to_damptime (gamma)

Variables

- int damping_models.NE = 10
- float damping_models.Emin = 0.99∗cst.GeV
- float damping_models.Emax = 100.01∗cst.TeV
- string damping_models.egridtype = "logspace"
- damping_models.E = grid.grid(Emin, Emax, 2∗∗NE, egridtype)
- list damping_models.phases = [ism.HII, ism.WIM, ism.WNM, ism.CNM, ism.DiM, ism.DeM, ism.DeC]
- list damping_models.xlim = [Emin/cst.GeV, Emax/cst.GeV]
- list damping_models.xlims = [xlim, xlim, xlim, xlim, xlim, xlim, xlim]
- list damping_models.ylim = [1e-14, 1e-3]
- list damping_models.ylims = [ylim, ylim, ylim, ylim, ylim, ylim, ylim]
- list damping_models.Name = ["HII", "WIM", "WNM", "CNM", "DiM", "DeM", "DeC"]
- int damping_models.size_x = 4
- int damping_models.size_y = 3
- int damping_models.sub_x = 2
- int damping_models.sub_y = 4
- damping_models.fig = plt.figure(figsize=(size_x∗sub_x,size_y∗sub_y))
- damping_models.gs = gridspec.GridSpec(ncols= sub_x, nrows = sub_y, figure = fig)
- damping_models.wspace
- damping_models.hspace
- list damping_models.pos_1 = [0, 0, 1, 1, 2, 2, 3, 3]
- list damping_models.pos_2 = [0, 1, 0, 1, 0, 1, 0, 1]
- damping_models.wR_Alfven = np.zeros(len(E))
- damping_models.wI_Alfven = np.zeros(len(E))
- damping_models.wR_Alfven_o1 = np.zeros(len(E))
- damping_models.wI_Alfven_o1 = np.zeros(len(E))
- damping_models.wR_Alfven_o2 = np.zeros(len(E))
- damping_models.wI_Alfven_o2 = np.zeros(len(E))
- damping_models.Ep = np.NaN
- damping_models.Em = np.NaN
- damping_models.Gamma_lz = np.zeros(len(E))
- damping_models.Gamma_nlld_inf = np.zeros(len(E))
- damping_models.Gamma_nlld_sup = np.zeros(len(E))
- damping_models.in_damping = dp.IonNeutral_Damping(E[e], phases[pi], nu_n = 0, theta = 0)
- damping_models.lz_damping = dp.damping_lazarian_nopos(E[e], phases[pi])
- damping_models.lz_min = lz_damping[1]
- int damping_models.linf = 1e-4
- int damping_models.lsup = 1e-1
- damping_models.ax = fig.add_subplot(gs[pos_1[pi], pos_2[pi]])
- damping_models.GeV
- damping_models.c
- damping_models.ls
- damping_models.lw
- damping_models.alpha
- damping_models.color
- damping_models.facecolor
- damping_models.x
- damping_models.y
- damping_models.label
- damping_models.loc
- damping_models.bbox_to_anchor
- damping_models.bbox_inches
- damping_models.pad_inches

4.46 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/show_models/electrons_emax_t.py File Reference

Namespaces

- electrons_emax_t

Functions

- def electrons_emax_t.InverseTrigonalMatrix (T)

  FUNCTIONS IN ORDER TO CREATE A GOOD SPLINE !!! #.
- def electrons_emax_t.ProductMatrix (A, B)
- def electrons_emax_t.InterpolatingSpline (X, Y)
- def electrons_emax_t.Rsh (nt)
- def electrons_emax_t.B (t, ts, tB, alpha_B, BISM, Bfree)

  ELECTRON ESCAPE MODEL (from Ohira et al.
- def electrons_emax_t.eta_g (t, ts, tB, alpha, alpha_B, eta_free)
- def electrons_emax_t.Em_age (t, ts, tB, alpha_B, alpha, BISM, Bfree, eta_acc, eta_free, Rs)
- def electrons_emax_t.Em_cool (t, ts, tB, alpha_B, alpha, BISM, Bfree, Ems)
- def electrons_emax_t.Em_esc (t, ts, tB, alpha_B, alpha, BISM, Bfree, eta_acc, eta_free, eta_esc, Rs)
- def electrons_emax_t.Emax_electrons (time)
- def electrons_emax_t.escape_time (E, tSed, EM, delta)

Variables

- float electrons_emax_t.alpha = 2.6
- int electrons_emax_t.alpha_B = 9./10
- int electrons_emax_t.xhi_m = 1
- float electrons_emax_t.xhi_cr = 0.1
- int electrons_emax_t.E51 = 1
- int electrons_emax_t.Mej = 1
- int electrons_emax_t.C06 = 1
- int electrons_emax_t.beta = 1
- int electrons_emax_t.phi_c = 1
- int electrons_emax_t.vej8 = 10.∗(E51/Mej)∗∗(0.5)
- float electrons_emax_t.nt = 0.35
- float electrons_emax_t.tsed = 0.3∗E51∗∗(-0.5)∗Mej∗nt∗∗(-1./3)∗cst.kyr

  FUNCTIONS IN ORDER TO MAKE OUR SNR EXPAND IN THE ISM #.
- def electrons_emax_t.EM = Emax_electrons(tsed)
- electrons_emax_t.E = np.logspace(np.log10(1∗cst.GeV), np.log10(100∗cst.TeV), num=100)
- electrons_emax_t.tesc = np.zeros(len(E))

4.47 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/show_models/EscapeModel_protons.py File Reference

Namespaces

- EscapeModel_protons

Functions

- def EscapeModel_protons.InverseTrigonalMatrix (T)

  FUNCTIONS IN ORDER TO CREATE A GOOD SPLINE !!! #.
- def EscapeModel_protons.ProductMatrix (A, B)
- def EscapeModel_protons.InterpolatingSpline (X, Y)
- def EscapeModel_protons.f1 (x, const)
- def EscapeModel_protons.df1dx (x, const)
- def EscapeModel_protons.f2 (x, const)
- def EscapeModel_protons.df2dx (x, const)
- def EscapeModel_protons.NewtonRaphson (f, df, x0, eps, const)
- def EscapeModel_protons.Gettesc (E, delta)

Variables

- float EscapeModel_protons.nt = 0.35
- int EscapeModel_protons.xhi_m = 1
- float EscapeModel_protons.xhi_cr = 0.1
- int EscapeModel_protons.E51 = 1
- int EscapeModel_protons.Mej = 1
- int EscapeModel_protons.C06 = 1
- int EscapeModel_protons.beta = 1
- int EscapeModel_protons.phi_c = 1
- int EscapeModel_protons.vej8 = 10.*(E51/Mej)**(0.5)
- int EscapeModel_protons.tini = 1e-4*cst.kyr

  FUNCTIONS IN ORDER TO MAKE OUR SNR EXPAND IN THE ISM #.
- float EscapeModel_protons.tfree = 0.3*E51**(-0.5)*Mej*nt**(-1./3)*cst.kyr
- float EscapeModel_protons.tPDS = np.exp(-1.)*3.61e4*E51**(3./14)/(xhi_m**(5./14)*nt**(4./7))*cst.yr
- float EscapeModel_protons.tMCS = min(61*vej8**3/(xhi_m**(9./14)*nt**(3./7)*E51**(3./14)), 476./(xhi_m*phi_c)**(9./14))*tPDS
- int EscapeModel_protons.tmerge = 153.*(E51**(1./14)*nt**(1./7)*xhi_m**(3./14)/(beta*C06))**(10./7)*tPDS
- EscapeModel_protons.tmax = min(tMCS, tmerge)
- float EscapeModel_protons.R_free = 5.0*(E51/nt)**(1./5)*(1 - (0.05*Mej**(5./6))/(E51**0.5*nt**(1./3)*(tfree/cst.kyr)))**(2./5)*(tfree/cst.kyr)**(2./5)*cst.pc
- float EscapeModel_protons.R_ini = R_free*(tini/tfree)**(1.)
- float EscapeModel_protons.R_PDS = 5.0*(E51/nt)**(1./5)*(1 - (0.05*Mej**(5./6))/(E51**0.5*nt**(1./3)*(tPDS/cst.kyr)))**(2./5)*(tPDS/cst.kyr)**(2./5)*cst.pc
- float EscapeModel_protons.R_MCS = R_PDS*(tMCS/tPDS)**(3./10)
- float EscapeModel_protons.R_merge = R_MCS*(tmerge/tMCS)**(1./4)
- EscapeModel_protons.t = np.array([tini, tfree, tPDS, tMCS, tmerge])
- EscapeModel_protons.R = np.array([R_ini, R_free, R_PDS, R_MCS, R_merge])
- EscapeModel_protons.logt = np.empty(len(t))
- EscapeModel_protons.logR = np.empty(len(R))
- def EscapeModel_protons.f_SNR = InterpolatingSpline(logt, logR)
- EscapeModel_protons.logt_new = np.linspace(logt[0], logt[-1], 100)
- EscapeModel_protons.logr_new = np.empty(len(logt_new))
- EscapeModel_protons.t_new = np.empty(len(logt_new))
- EscapeModel_protons.r_new = np.empty(len(logr_new))
- EscapeModel_protons.u_sh = np.empty(len(r_new))
- float EscapeModel_protons.gamma = 2.2
- float EscapeModel_protons.Emin = 0.1*cst.GeV
- EscapeModel_protons.Emax = np.empty(len(t_new))
- int EscapeModel_protons.eps = 1e-4

- int EscapeModel_protons.x0 = 10.∗cst.GeV
- float EscapeModel_protons.a = Emin
- int EscapeModel_protons.b = beta
- tuple EscapeModel_protons.c = (beta/(1+beta))∗cst.e∗np.sqrt(4∗np.pi∗nt∗cst.mp)/(10.∗cst.c)∗xhi_cr∗u_↩ sh[ii]∗∗2∗r_new[ii]
- EscapeModel_protons.niter
- EscapeModel_protons.EMAX = max(Emax)
- int EscapeModel_protons.delta = 2.
- float EscapeModel_protons.tSed = tfree
- EscapeModel_protons.Ecr = np.logspace(np.log10(0.1∗cst.GeV), np.log10(100.∗cst.TeV), 100)
- EscapeModel_protons.tesc = np.empty(len(Ecr))
- EscapeModel_protons.figsize

  Model figure #.
- EscapeModel_protons.pc
- EscapeModel_protons.marker
- EscapeModel_protons.lw
- EscapeModel_protons.label
- EscapeModel_protons.GeV
- EscapeModel_protons.kyr

4.48 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/show↩ _models/EscapeModel_protons_2.py File Reference

Namespaces

- EscapeModel_protons_2

Functions

- def EscapeModel_protons_2.InverseTrigonalMatrix (T)

  FUNCTIONS IN ORDER TO CREATE A GOOD SPLINE !!! #.
- def EscapeModel_protons_2.ProductMatrix (A, B)
- def EscapeModel_protons_2.InterpolatingSpline (X, Y)
- def EscapeModel_protons_2.f1 (x, const)
- def EscapeModel_protons_2.df1dx (x, const)
- def EscapeModel_protons_2.f2 (x, const)
- def EscapeModel_protons_2.df2dx (x, const)
- def EscapeModel_protons_2.NewtonRaphson (f, df, x0, eps, const)
- def EscapeModel_protons_2.getSNR (phase, size=100)
- def EscapeModel_protons_2.Gettesc (E, delta, tSed, EMAX, Emin=0.1 ∗cst.GeV)
- def EscapeModel_protons_2.getEmax (t_new, u_sh, r_new, phase, gamma=2.2, Emin=0.1 ∗cst.GeV, eps=1e-4, x0=10.∗cst.GeV)

Variables

- EscapeModel_protons_2.Ecr = np.logspace(np.log10(0.1∗cst.GeV), np.log10(100.∗cst.TeV), 1000)
- def EscapeModel_protons_2.SNR_HII = getSNR(ism.HII, size = 100)
- def EscapeModel_protons_2.emax_HII
- def EscapeModel_protons_2.SNR_WIM = getSNR(ism.WIM, size = 100)
- def EscapeModel_protons_2.emax_WIM
- def EscapeModel_protons_2.SNR_WNM = getSNR(ism.WNM, size = 100)
- def EscapeModel_protons_2.emax_WNM
- def EscapeModel_protons_2.SNR_CNM = getSNR(ism.CNM, size = 100)
- def EscapeModel_protons_2.emax_CNM
- def EscapeModel_protons_2.SNR_DiM = getSNR(ism.DiM, size = 100)
- def EscapeModel_protons_2.emax_DiM
- int EscapeModel_protons_2.delta = 2.
- EscapeModel_protons_2.tesc_HII = np.empty(len(Ecr))
- EscapeModel_protons_2.tesc_WIM = np.empty(len(Ecr))
- EscapeModel_protons_2.tesc_WNM = np.empty(len(Ecr))
- EscapeModel_protons_2.tesc_CNM = np.empty(len(Ecr))
- EscapeModel_protons_2.tesc_DiM = np.empty(len(Ecr))
- EscapeModel_protons_2.tesc_HII_3 = np.empty(len(Ecr))
- EscapeModel_protons_2.tesc_WIM_3 = np.empty(len(Ecr))
- EscapeModel_protons_2.tesc_WNM_3 = np.empty(len(Ecr))
- EscapeModel_protons_2.tesc_CNM_3 = np.empty(len(Ecr))
- EscapeModel_protons_2.tesc_DiM_3 = np.empty(len(Ecr))
- int EscapeModel_protons_2.size_x = 4
- float EscapeModel_protons_2.size_y = 3.5
- int EscapeModel_protons_2.sub_x = 2
- int EscapeModel_protons_2.sub_y = 1
- EscapeModel_protons_2.fig = plt.figure(figsize=(size_x∗sub_x,size_y∗sub_y))
- EscapeModel_protons_2.gs = gridspec.GridSpec(ncols= sub_x, nrows = sub_y, figure = fig)
- EscapeModel_protons_2.wspace
- EscapeModel_protons_2.hspace
- EscapeModel_protons_2.ax0 = fig.add_subplot(gs[0])
- EscapeModel_protons_2.GeV
- EscapeModel_protons_2.c
- EscapeModel_protons_2.label
- EscapeModel_protons_2.loc
- EscapeModel_protons_2.ncol
- EscapeModel_protons_2.bbox_to_anchor
- EscapeModel_protons_2.ax1 = fig.add_subplot(gs[1])
- EscapeModel_protons_2.kyr
- EscapeModel_protons_2.ls
- EscapeModel_protons_2.pad

4.49 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/show↩ _models/obsolette/background_diffusion_coefficient_2.py File Reference

Namespaces

- background_diffusion_coefficient_2

Functions

- def background_diffusion_coefficient_2.IonNeutral_Damping (k, medium_props, nu_n=0, theta=0)
- def background_diffusion_coefficient_2.R (k, medium_props, particles_props, mu, kind="+")
- def background_diffusion_coefficient_2.g_s (k, kmin, q, medium_props)

Variables

- background_diffusion_coefficient_2.medium_props = ism.WNM
- float background_diffusion_coefficient_2.E = 0.001∗cst.GeV
- background_diffusion_coefficient_2.m = cst.mp
- int background_diffusion_coefficient_2.gamma = 1 + (E /(m∗cst.c∗∗2))
- background_diffusion_coefficient_2.v = cst.c∗np.sqrt(1 - (1/(E/(m∗cst.c∗∗2) + 1))∗∗2)
- int background_diffusion_coefficient_2.p = gamma∗m∗v
- background_diffusion_coefficient_2.Omega0 = cst.e∗medium_props.get("B")/(m∗cst.c)
- int background_diffusion_coefficient_2.Omega = Omega0/gamma
- dictionary background_diffusion_coefficient_2.particles_props = {"v":v, "Omega":Omega}
- background_diffusion_coefficient_2.mu = np.linspace(-0.99, 0.99, 100)
- background_diffusion_coefficient_2.k = np.logspace(-20, -10, 100)
- background_diffusion_coefficient_2.D_uu = np.zeros(len(mu))
- int background_diffusion_coefficient_2.kmin = 1e-17
- float background_diffusion_coefficient_2.q = 1.5
- int background_diffusion_coefficient_2.k_zz = 0.
- float background_diffusion_coefficient_2.dk = 0.5∗(k[ii+1] - k[ii-1])
- background_diffusion_coefficient_2.B0 = medium_props.get("B")
- def background_diffusion_coefficient_2.w = IonNeutral_Damping(k[ii], medium_props)
- def background_diffusion_coefficient_2.wtot = w.get("wr") + 1j∗w.get("wi")
- float background_diffusion_coefficient_2.I = dk∗g_s(k[ii], kmin, q, medium_props)∗(1 - (mu[jj]∗wtot)/(k[ii]∗v))∗∗2

4.50 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/show_models/SNR_evolution.py File Reference

Namespaces

- SNR_evolution

Functions

- def SNR_evolution.InverseTrigonalMatrix (T)

  FUNCTIONS IN ORDER TO CREATE A GOOD SPLINE !!! #.
- def SNR_evolution.ProductMatrix (A, B)
- def SNR_evolution.InterpolatingSpline (X, Y)
- def SNR_evolution.Rsh (nt)

Variables

- list SNR_evolution.marker = ['X', 'o', 's', 'v']
- int SNR_evolution.size_x = 6
- int SNR_evolution.size_y = 4
- int SNR_evolution.sub_x = 1
- int SNR_evolution.sub_y = 2
- SNR_evolution.fig = plt.figure(figsize=(size_x∗sub_x,size_y∗sub_y))
- SNR_evolution.gs = gridspec.GridSpec(ncols= sub_x, nrows = sub_y, figure = fig)
- SNR_evolution.wspace
- SNR_evolution.hspace
- SNR_evolution.ax0 = fig.add_subplot(gs[0])
- SNR_evolution.pc
- SNR_evolution.c
- SNR_evolution.label
- SNR_evolution.lw
- SNR_evolution.loc
- SNR_evolution.ncol
- SNR_evolution.bbox_to_anchor
- SNR_evolution.ax1 = fig.add_subplot(gs[1])
- SNR_evolution.kms

4.51 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/ShowInjectionEvolution.py File Reference

Namespaces

- ShowInjectionEvolution

Functions

- def ShowInjectionEvolution.readDataXE (file_name, NX, NE)
- def ShowInjectionEvolution.readAxis (file_name)

Variables

- ShowInjectionEvolution.index = np.logspace(1, np.log10(900), 10)
- ShowInjectionEvolution.figsize
- def ShowInjectionEvolution.X = readAxis("../data_ini/X.dat")
- def ShowInjectionEvolution.E = readAxis("../data_ini/E.dat")
- string ShowInjectionEvolution.loc_id = ""
- def ShowInjectionEvolution.data = readDataXE("../data_out/Pcr_"+loc_id+".dat", 2∗∗11, 2∗∗5)

4.52 /home/lbrahimi/TRAVAIL/THESE/Travaux/CR_diffusion/CR_SPECTRA/tools/test_tesc.py File Reference

Namespaces

- test_tesc

Functions

- def test_tesc.tesc (E)
- def test_tesc.gauss (t, sig, mu)
- def test_tesc.sig (t)

Variables

- float test_tesc.GeV = 0.00160218
- int test_tesc.kyr = 1e3∗24∗60∗60∗365.25
- float test_tesc.rho_0 = 0.35
- float test_tesc.e = 4.8032e-10
- float test_tesc.c = 2.998e10
- float test_tesc.xhi_cr = 0.1
- float test_tesc.xhi_0 = 2.026
- float test_tesc.beta = 0.2
- int test_tesc.Esn = 1e51
- float test_tesc.Emin = 0.1∗GeV
- test_tesc.E = np.logspace(np.log10(10.∗GeV), np.log10(1e3∗GeV), 100)
- test_tesc.t = np.linspace(0.01∗kyr, 1e3∗kyr, 10000)
- test_tesc.Qcr = np.empty((len(E), len(t)))
- test_tesc.figsize
- test_tesc.label

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