analysis_roi

March 7, 2024

[1]:
```
%matplotlib inline
```

[2]:
```
import warnings
warnings.simplefilter("ignore", UserWarning)
```

[3]:
```
from feupy.catalog.pulsar.atnf import SourceCatalogATNF

from feupy.target import Target

from feupy.plotters import *

from feupy.utils.string_handling import name_to_txt

from feupy.analysis import CounterpartsConfig, Counterparts
from feupy.roi import ROI

from astropy import units as u

from gammapy.utils.scripts import make_path
from gammapy.datasets import Datasets
from gammapy.modeling.models import SkyModel, ExpCutoffPowerLawSpectralModel
```

[4]:
```
catalog = SourceCatalogATNF()
```

[5]:
```
catalog.table
```

[5]:
```
<Table length=3389>
    JNAME        RAJ2000    RAJ2000_ERR  …     EDOT     TYPE   ASSOC
                   deg          deg       …   erg / s
   bytes16       float64      float64     …   float64   bytes7 bytes12
-------------- ------------ ------------ … ----------- ------ -------
PSR J0002+6216        0.742        0.000 …   1.534e+35     HE     GRS
PSR J0006+1834        1.520        0.001 …   2.479e+32   None    None
PSR J0007+7303        1.757        0.001 …   4.514e+35   NRAD     GRS
  PSR J0011+08        2.892        0.475 …          --   None    None
PSR J0012+5431        3.097        0.000 …   1.827e+29   RRAT    None
PSR J0014+4746        3.574        0.000 …   1.167e+31   None    None
```

```
            …          …          … …          …     …      …
  PSR J2352+65      358.000          -- …          --   None   None
PSR J2354+6155      358.520       0.000 …  7.613e+32   None   None
  PSR J2354-22      358.608          -- …          --   None   None
PSR J2355+0051      358.964       0.000 …  2.473e+33   None   None
PSR J2355+1523      358.953       0.000 …  1.263e+31   RRAT   None
PSR J2355+2246      358.957       0.001 …  2.392e+31   None   None
```

[6]:
```
target = catalog["PSR J1826-1334"]
```

[7]:
```
print(target.info())
```

```
*** Basic info ***

Catalog row index (zero-based) : 2095
Source name : PSR J1826-1334

*** Position info ***

RA: 276.555 deg +- 0.000 deg
DEC: -13.580 deg +- 0.000 deg

*** Timing and profile info ***

P0: 1.015e-01 +- 2.060e-13 s

*** Distance info ***

Dist: 3.61e+00 kpc
Dist_DM: 3.61e+00 kpc

*** Associations and survey info ***

Assoc: GR
Type: HE

*** Derived parameters info ***

Age: 2.14e+04 yr
BSurf: 2.80e+12 G
Edot: 2.84e+36 erg / s
```

[8]:
```
target_name = target.name
target_name
```

[8]:
```
'PSR J1826-1334'
```

[9]:
```
target_pos = target.position
target_pos
```

[9]:
```
<SkyCoord (ICRS): (ra, dec) in deg
    (276.55489583, -13.57966667)>
```

[10]:
```
pos_ra = target_pos.ra
pos_dec = target_pos.dec
```

[11]:
```
target_model = SkyModel(
    spectral_model=ExpCutoffPowerLawSpectralModel(),
    name=target_name
)
```

[12]:
```
print(target_model)
```

```
SkyModel

  Name                      : PSR J1826-1334
  Datasets names            : None
  Spectral model type       : ExpCutoffPowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                         :      1.500   +/-    0.00
    amplitude                     :   1.00e-12   +/- 0.0e+00 1 / (TeV s cm2)
    reference             (frozen):      1.000       TeV
    lambda_                       :      0.100   +/-    0.00 1 / TeV
    alpha                 (frozen):      1.000
```

[13]:
```
target = Target(
    target_name,
    pos_ra,
    pos_dec,
    spectral_model=target_model.spectral_model
)
print(target)
```

```
*** Basic info ***

Source name : PSR J1826-1334

*** Position info ***
```

```
RA: 276.555 deg
DEC: -13.580 deg

*** Spectral info ***

Spectrum type:  ExpCutoffPowerLawSpectralModel
index: 1.5 +- 0
amplitude: 1e-12 +- 0 TeV⁻¹ s⁻¹ cm⁻²
reference: 1.0 +- 0 TeV
lambda_: 0.1 +- 0 TeV⁻¹
alpha: 1.0 +- 0
```

[14]:
```
radius = 1*u.deg
```

[15]:
```
roi = ROI(target, radius)
```

[16]:
```
print(roi.info)
```

```
Target:

*** Basic info ***

Source name : PSR J1826-1334

*** Position info ***

RA: 276.555 deg
DEC: -13.580 deg

*** Spectral info ***

Spectrum type:  ExpCutoffPowerLawSpectralModel
index: 1.5 +- 0
amplitude: 1e-12 +- 0 TeV⁻¹ s⁻¹ cm⁻²
reference: 1.0 +- 0 TeV
lambda_: 0.1 +- 0 TeV⁻¹
alpha: 1.0 +- 0

Region:
radius = 1.00deg
```

[17]:
```
roi.dict
```

[17]:
```
{'target': {'name': 'PSR J1826-1334',
  'position': {'lon': <Longitude 276.55489583 deg>,
   'lat': <Latitude -13.57966667 deg>,
   'frame': 'icrs'},
  'model': {'name': 'PSR J1826-1334',
   'type': 'SkyModel',
   'spectral': {'type': 'ExpCutoffPowerLawSpectralModel',
    'parameters': [{'name': 'index', 'value': 1.5},
     {'name': 'amplitude', 'value': 1e-12, 'unit': 'TeV-1 s-1 cm-2'},
     {'name': 'reference', 'value': 1.0, 'unit': 'TeV'},
     {'name': 'lambda_', 'value': 0.1, 'unit': 'TeV-1'},
     {'name': 'alpha', 'value': 1.0}]}}},
 'radius': <Quantity 1. deg>}
```

[18]:
```
config = CounterpartsConfig()
```

[19]:
```
config.roi = roi.dict
```

[20]:
```
print(config)
```

```
CounterpartsConfig

    general:
        log: {level: info, filename: null, filemode: null, format: null,
datefmt: null}
        outdir: .
        path_file: null
    roi:
        target:
            name: PSR J1826-1334
            position: {frame: icrs, lon: 276.55489583333326 deg, lat:
-13.579666666666666
                    deg}
            model:
                name: PSR J1826-1334
                type: SkyModel
                spectral:
                    type: ExpCutoffPowerLawSpectralModel
                    parameters:
                    - {name: index, value: 1.5}
                    - {name: amplitude, value: 1.0e-12, unit: TeV-1 s-1 cm-2}
                    - {name: reference, value: 1.0, unit: TeV}
                    - {name: lambda_, value: 0.1, unit: TeV-1}
                    - {name: alpha, value: 1.0}
        radius: 1.0 deg
        catalogs: all
        dict_sep: {}
```

```
        leg_style: {}
    energy_range: {min: null, max: null}
```

[21]:
```
config.roi.catalogs = "all"
```

[22]:
```
e_edges_min=0.1*u.TeV
config.energy_range.min = e_edges_min

# e_edges_max=100.*u.TeV
# config.energy_range.max = e_edges_max
```

[23]:
```
analysis_path = make_path(f"./{name_to_txt(target_name)}")
analysis_path.mkdir(parents=True, exist_ok=True)
```

[24]:
```
config.general.path_file = analysis_path
```

[25]:
```
config.write(overwrite=True)
```

[26]:
```
analysis = Counterparts(config)
```

```
Setting logging config: {'level': 'INFO', 'filename': None, 'filemode': None,
'format': None, 'datefmt': None}
```

[27]:
```
analysis.run()
```

```
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.

The error is: (2HWC J1825-134) 'SourceCatalogObject2HWC' object has no attribute
'flux_points'
The error is: (3FGL J1823.2-1339) index -1 is out of bounds for axis 0 with size
0
The error is: (3FGL J1824.5-1351e) index -1 is out of bounds for axis 0 with
size 0

No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.

The error is: (3FGL J1826.1-1256) index -1 is out of bounds for axis 0 with size
0

No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
```

```
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.

The error is: (3HWC J1825-134) 'SourceCatalogObject3HWC' object has no attribute
'flux_points'

No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.

Total number of gamma sources: 19
Total number of flux points tables: 19
Total number of pulsars: 8
```

[28]:
```
analysis.df_sep
```

[28]:

	Source name	RA(deg)	dec.(deg)	Sep.(deg)
0	HESS J1826-130: gamma-cat	276.504181	-13.091110	0.491042
1	HESS J1825-137: gamma-cat	276.554413	-13.580040	0.000600
2	HESS J1825-137: hgps	276.259552	-13.965834	0.481050
3	HESS J1826-130: hgps	276.508728	-13.017380	0.564079
4	4FGL J1823.3-1340	275.836304	-13.667600	0.703888
5	4FGL J1824.1-1304	276.032196	-13.072000	0.718627
6	4FGL J1824.4-1350e	276.110992	-13.839000	0.503225
7	4FGL J1826.1-1256	276.535187	-12.941500	0.638455
8	4FGL J1828.1-1312	277.027588	-13.201900	0.595114
9	2FHL J1824.5-1350e	276.130005	-13.850000	0.493421
10	3FHL J1823.3-1339	275.840393	-13.662771	0.699361
11	3FHL J1824.5-1351e	276.130005	-13.852100	0.494573
12	3FHL J1826.1-1256	276.541870	-12.942548	0.637245
13	2HWC J1825-134	276.460000	-13.400000	0.201978
14	HAWC J1825-138	276.380000	-13.860000	0.327803
15	HAWC J1826-128	276.500000	-12.860000	0.721648
16	HAWC J1825-134	276.440000	-13.420000	0.194872
17	eHWC J1825-134	276.400000	-13.370000	0.258167
18	LHAASO J1825-1326	276.450000	-13.450000	0.164972
19	PSR J1822-1400	275.725175	-14.000667	0.909153
20	PSR J1823-1347	275.851042	-13.798333	0.717969
21	PSR J1824-1350	276.209087	-13.839167	0.424508
22	PSR J1824-1423	276.239112	-14.384806	0.861478
23	PSR J1826-1256	276.535542	-12.942500	0.637445
24	PSR J1826-1334	276.554896	-13.579667	0.000000
25	PSR J1826-1419	276.676629	-14.322667	0.752334
26	PSR J1828-1336	277.178542	-13.612500	0.607058

[29]:
```
len(analysis.sources)
```

[29]: 19

[30]:
```
len(analysis.datasets)
```

[30]: 19

[31]:
```
print(analysis.datasets)
```

```
Datasets
--------

Dataset 0:

  Type       : FluxPointsDataset
  Name       : HESS J1826-130: gamma-cat
  Instrument :
  Models     : ['HESS_J1826-130_gamma-cat_ecpl']

Dataset 1:

  Type       : FluxPointsDataset
  Name       : HESS J1825-137: gamma-cat
  Instrument :
  Models     : ['HESS_J1825-137_gamma-cat_ecpl']

Dataset 2:

  Type       : FluxPointsDataset
  Name       : HESS J1825-137: hgps
  Instrument :
  Models     : ['HESS_J1825-137_hgps_ecpl']

Dataset 3:

  Type       : FluxPointsDataset
  Name       : HESS J1826-130: hgps
  Instrument :
  Models     : ['HESS_J1826-130_hgps_pl']

Dataset 4:

  Type       : FluxPointsDataset
  Name       : 4FGL J1823.3-1340
  Instrument :
  Models     : ['4FGL_J1823.3-1340_lp']

Dataset 5:
```

```
  Type       : FluxPointsDataset
  Name       : 4FGL J1824.1-1304
  Instrument :
  Models     : ['4FGL_J1824.1-1304_lp']

Dataset 6:

  Type       : FluxPointsDataset
  Name       : 4FGL J1824.4-1350e
  Instrument :
  Models     : ['4FGL_J1824.4-1350e_lp']

Dataset 7:

  Type       : FluxPointsDataset
  Name       : 4FGL J1826.1-1256
  Instrument :
  Models     : ['4FGL_J1826.1-1256_secpl-4fgl-dr3']

Dataset 8:

  Type       : FluxPointsDataset
  Name       : 4FGL J1828.1-1312
  Instrument :
  Models     : ['4FGL_J1828.1-1312_lp']

Dataset 9:

  Type       : FluxPointsDataset
  Name       : 2FHL J1824.5-1350e
  Instrument :
  Models     : ['2FHL_J1824.5-1350e_pl-2']

Dataset 10:

  Type       : FluxPointsDataset
  Name       : 3FHL J1823.3-1339
  Instrument :
  Models     : ['3FHL_J1823.3-1339_pl']

Dataset 11:

  Type       : FluxPointsDataset
  Name       : 3FHL J1824.5-1351e
  Instrument :
  Models     : ['3FHL_J1824.5-1351e_lp']
```

```
Dataset 12:

  Type       : FluxPointsDataset
  Name       : 3FHL J1826.1-1256
  Instrument :
  Models     : ['3FHL_J1826.1-1256_pl']

Dataset 13:

  Type       : FluxPointsDataset
  Name       : 2HWC J1825-134
  Instrument :
  Models     : ['2HWC_J1825-134_pl']

Dataset 14:

  Type       : FluxPointsDataset
  Name       : HAWC J1825-138
  Instrument :
  Models     : ['HAWC_J1825-138_ecpl']

Dataset 15:

  Type       : FluxPointsDataset
  Name       : HAWC J1826-128
  Instrument :
  Models     : ['HAWC_J1826-128_ecpl']

Dataset 16:

  Type       : FluxPointsDataset
  Name       : HAWC J1825-134
  Instrument :
  Models     : ['HAWC_J1825-134_pl']

Dataset 17:

  Type       : FluxPointsDataset
  Name       : eHWC J1825-134
  Instrument :
  Models     : ['eHWC_J1825-134_ecpl']

Dataset 18:

  Type       : FluxPointsDataset
  Name       : LHAASO J1825-1326
  Instrument :
  Models     : ['LHAASO_J1825-1326_lp']
```

[32]:
```
print(analysis.models)
```

```
DatasetModels

Component 0: SkyModel

  Name                      : HESS_J1826-130_gamma-cat_ecpl
  Datasets names            : HESS J1826-130: gamma-cat
  Spectral model type       : ExpCutoffPowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                         :      1.610   +/-    0.11
    amplitude                     :   8.62e-13   +/- 7.3e-14 1 / (TeV s cm2)
    reference             (frozen):      1.000       TeV
    lambda_                       :      0.080   +/-    0.03 1 / TeV
    alpha                 (frozen):      1.000

Component 1: SkyModel

  Name                      : HESS_J1825-137_gamma-cat_ecpl
  Datasets names            : HESS J1825-137: gamma-cat
  Spectral model type       : ExpCutoffPowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                         :      2.260   +/-    0.03
    amplitude                     :   2.10e-11   +/- 5.0e-13 1 / (TeV s cm2)
    reference             (frozen):      1.000       TeV
    lambda_                       :      0.040   +/-    0.01 1 / TeV
    alpha                 (frozen):      1.000

Component 2: SkyModel

  Name                      : HESS_J1825-137_hgps_ecpl
  Datasets names            : HESS J1825-137: hgps
  Spectral model type       : ExpCutoffPowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                         :      2.151   +/-    0.06
    amplitude                     :   6.95e-11   +/- 2.9e-12 1 / (TeV s cm2)
    reference             (frozen):      0.650       TeV
    lambda_                       :      0.074   +/-    0.02 1 / TeV
    alpha                 (frozen):      1.000
```

```
Component 3: SkyModel

  Name                      : HESS_J1826-130_hgps_pl
  Datasets names            : HESS J1826-130: hgps
  Spectral model type       : PowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                         :      2.037   +/-    0.10
    amplitude                     :   2.73e-13   +/- 3.8e-14 1 / (TeV s cm2)
    reference             (frozen):      2.056       TeV

Component 4: SkyModel

  Name                      : 4FGL_J1823.3-1340_lp
  Datasets names            : 4FGL J1823.3-1340
  Spectral model type       : LogParabolaSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    amplitude                     :   2.07e-12   +/- 9.2e-14 1 / (MeV s cm2)
    reference             (frozen):   2386.793       MeV
    alpha                         :      2.313   +/-    0.06
    beta                          :      0.234   +/-    0.04

Component 5: SkyModel

  Name                      : 4FGL_J1824.1-1304_lp
  Datasets names            : 4FGL J1824.1-1304
  Spectral model type       : LogParabolaSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    amplitude                     :   3.49e-12   +/- 5.4e-13 1 / (MeV s cm2)
    reference             (frozen):   1238.985       MeV
    alpha                         :      3.192   +/-    0.32
    beta                          :      0.894   +/-    0.22

Component 6: SkyModel

  Name                      : 4FGL_J1824.4-1350e_lp
  Datasets names            : 4FGL J1824.4-1350e
  Spectral model type       : LogParabolaSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    amplitude                     :   1.47e-13   +/- 8.0e-15 1 / (MeV s cm2)
```

```
    reference             (frozen):  11602.418       MeV
    alpha                         :      1.685   +/-    0.04
    beta                          :      0.047   +/-    0.02

Component 7: SkyModel

  Name                      : 4FGL_J1826.1-1256_secpl-4fgl-dr3
  Datasets names            : 4FGL J1826.1-1256
  Spectral model type       : SuperExpCutoffPowerLaw4FGLDR3SpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    amplitude                   :   1.22e-11   +/- 1.9e-13 1 / (MeV s cm2)
    reference             (frozen):   2247.160       MeV
    expfactor                   :      0.665   +/-    0.03
    index_1                     :      2.465   +/-    0.03
    index_2                     :      0.687   +/-    0.11

Component 8: SkyModel

  Name                      : 4FGL_J1828.1-1312_lp
  Datasets names            : 4FGL J1828.1-1312
  Spectral model type       : LogParabolaSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    amplitude                   :   5.27e-13   +/- 8.3e-14 1 / (MeV s cm2)
    reference             (frozen):   2197.682       MeV
    alpha                       :      2.601   +/-    0.32
    beta                        :      0.620   +/-    0.30

Component 9: SkyModel

  Name                      : 2FHL_J1824.5-1350e_pl-2
  Datasets names            : 2FHL J1824.5-1350e
  Spectral model type       : PowerLaw2SpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    amplitude                   :   7.15e-10   +/- 6.5e-11 1 / (s cm2)
    index                       :      1.890   +/-    0.11
    emin                  (frozen):      0.050       TeV
    emax                  (frozen):      2.000       TeV

Component 10: SkyModel

  Name                      : 3FHL_J1823.3-1339_pl
  Datasets names            : 3FHL J1823.3-1339
```

```
  Spectral model type       : PowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                        :      3.824   +/-    0.47
    amplitude                    :   1.86e-11   +/- 3.2e-12 1 / (GeV s cm2)
    reference             (frozen):     13.914       GeV

Component 11: SkyModel

  Name                      : 3FHL_J1824.5-1351e_lp
  Datasets names            : 3FHL J1824.5-1351e
  Spectral model type       : LogParabolaSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    amplitude                    :   2.29e-11   +/- 1.9e-12 1 / (GeV s cm2)
    reference             (frozen):     33.405       GeV
    alpha                        :      1.527   +/-    0.10
    beta                         :      0.168   +/-    0.06

Component 12: SkyModel

  Name                      : 3FHL_J1826.1-1256_pl
  Datasets names            : 3FHL J1826.1-1256
  Spectral model type       : PowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                        :      4.331   +/-    0.51
    amplitude                    :   2.70e-11   +/- 4.0e-12 1 / (GeV s cm2)
    reference             (frozen):     13.178       GeV

Component 13: SkyModel

  Name                      : 2HWC_J1825-134_pl
  Datasets names            : 2HWC J1825-134
  Spectral model type       : PowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                        :      2.580   +/-    0.00
    amplitude                    :   1.38e-13   +/- 0.0e+00 1 / (TeV s cm2)
    reference             (frozen):      7.000       TeV

Component 14: SkyModel

  Name                      : HAWC_J1825-138_ecpl
```

```
  Datasets names            : HAWC J1825-138
  Spectral model type       : ExpCutoffPowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                         :      2.020   +/-    0.00
    amplitude                     :   2.70e-14   +/- 0.0e+00 1 / (TeV s cm2)
    reference              (frozen):     18.000       TeV
    lambda_                       :      0.037   +/-    0.00 1 / TeV
    alpha                  (frozen):      1.000

Component 15: SkyModel

  Name                      : HAWC_J1826-128_ecpl
  Datasets names            : HAWC J1826-128
  Spectral model type       : ExpCutoffPowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                         :      1.200   +/-    0.00
    amplitude                     :   2.70e-14   +/- 0.0e+00 1 / (TeV s cm2)
    reference              (frozen):     18.000       TeV
    lambda_                       :      0.042   +/-    0.00 1 / TeV
    alpha                  (frozen):      1.000

Component 16: SkyModel

  Name                      : HAWC_J1825-134_pl
  Datasets names            : HAWC J1825-134
  Spectral model type       : PowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                         :      2.280   +/-    0.00
    amplitude                     :   4.20e-15   +/- 0.0e+00 1 / (TeV s cm2)
    reference              (frozen):     18.000       TeV

Component 17: SkyModel

  Name                      : eHWC_J1825-134_ecpl
  Datasets names            : eHWC J1825-134
  Spectral model type       : ExpCutoffPowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                         :      2.120   +/-    0.00
    amplitude                     :   2.12e-13   +/- 0.0e+00 1 / (TeV s cm2)
    reference              (frozen):     10.000       TeV
```

```
    lambda_                         :      0.016   +/-    0.00 1 / TeV
    alpha                  (frozen):      1.000

Component 18: SkyModel

  Name                      : LHAASO_J1825-1326_lp
  Datasets names            : LHAASO J1825-1326
  Spectral model type       : LogParabolaSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    amplitude                     :   1.00e-12   +/- 0.0e+00 1 / (TeV s cm2)
    reference              (frozen):     10.000       TeV
    alpha                         :      0.920   +/-    0.00
    beta                          :      1.190   +/-    0.00
```

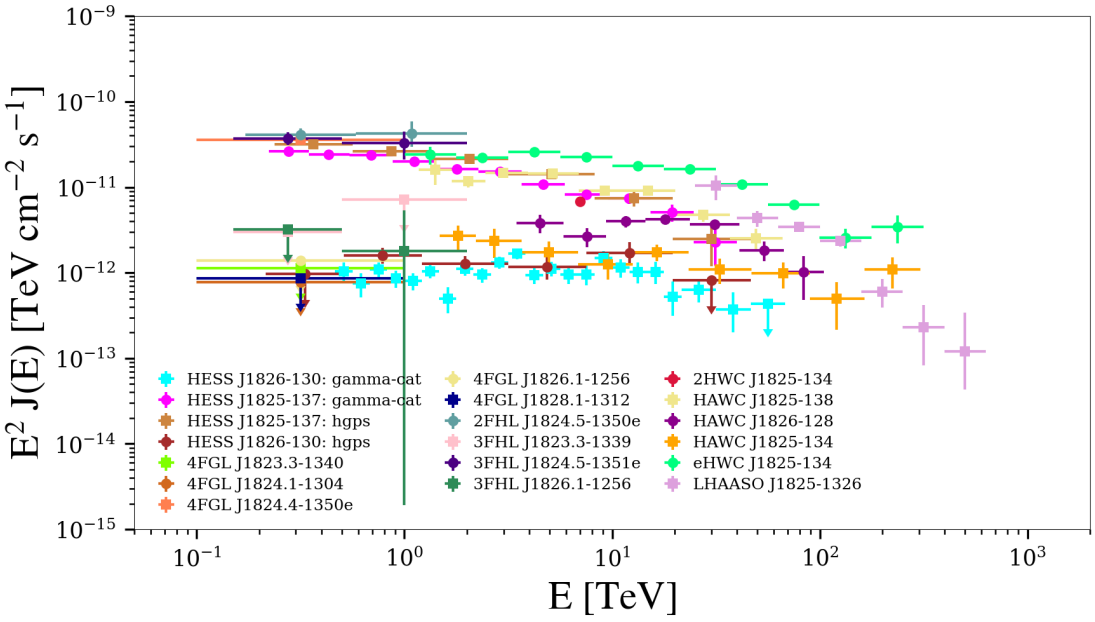
[33]:
```
leg_style = analysis.leg_style
```

[34]:
```
leg_style
```

[34]:
```
{'HESS J1826-130: gamma-cat': ('aqua', 's'),
 'HESS J1825-137: gamma-cat': ('fuchsia', 'o'),
 'HESS J1825-137: hgps': ('peru', 's'),
 'HESS J1826-130: hgps': ('brown', 'o'),
 '4FGL J1823.3-1340': ('chartreuse', 's'),
 '4FGL J1824.1-1304': ('chocolate', 'o'),
 '4FGL J1824.4-1350e': ('coral', 's'),
 '4FGL J1826.1-1256': ('khaki', 'o'),
 '4FGL J1828.1-1312': ('darkblue', 's'),
 '2FHL J1824.5-1350e': ('cadetblue', 'o'),
 '3FHL J1823.3-1339': ('pink', 's'),
 '3FHL J1824.5-1351e': ('indigo', 'o'),
 '3FHL J1826.1-1256': ('seagreen', 's'),
 '2HWC J1825-134': ('crimson', 'o'),
 'HAWC J1825-138': ('khaki', 's'),
 'HAWC J1826-128': ('darkmagenta', 'o'),
 'HAWC J1825-134': ('orange', 's'),
 'eHWC J1825-134': ('springgreen', 'o'),
 'LHAASO J1825-1326': ('plum', 's'),
 'PSR J1822-1400': ('maroon', 'o'),
 'PSR J1823-1347': ('navy', 's'),
 'PSR J1824-1350': ('olive', 'o'),
 'PSR J1824-1423': ('skyblue', 's'),
 'PSR J1826-1256': ('orange', 'o'),
 'PSR J1826-1334': ('orangered', 's'),
```

```
 'PSR J1826-1419': ('orchid', 'o'),
 'PSR J1828-1336': ('pink', 's'),
 'HESS_J1826-130_gamma-cat_ecpl': ('aqua', 'solid'),
 'HESS_J1825-137_gamma-cat_ecpl': ('fuchsia', 'dotted'),
 'HESS_J1825-137_hgps_ecpl': ('peru', 'dashed'),
 'HESS_J1826-130_hgps_pl': ('brown', 'dashdot'),
 '4FGL_J1823.3-1340_lp': ('chartreuse', 'solid'),
 '4FGL_J1824.1-1304_lp': ('chocolate', 'dotted'),
 '4FGL_J1824.4-1350e_lp': ('coral', 'dashed'),
 '4FGL_J1826.1-1256_secpl-4fgl-dr3': ('khaki', 'dashdot'),
 '4FGL_J1828.1-1312_lp': ('darkblue', 'solid'),
 '2FHL_J1824.5-1350e_pl-2': ('cadetblue', 'dotted'),
 '3FHL_J1823.3-1339_pl': ('pink', 'dashed'),
 '3FHL_J1824.5-1351e_lp': ('indigo', 'dashdot'),
 '3FHL_J1826.1-1256_pl': ('seagreen', 'solid'),
 '2HWC_J1825-134_pl': ('crimson', 'dotted'),
 'HAWC_J1825-138_ecpl': ('khaki', 'dashed'),
 'HAWC_J1826-128_ecpl': ('darkmagenta', 'dashdot'),
 'HAWC_J1825-134_pl': ('orange', 'solid'),
 'eHWC_J1825-134_ecpl': ('springgreen', 'dotted'),
 'LHAASO_J1825-1326_lp': ('plum', 'dashed')}
```

[35]:
```
plot_limits = dict(
    energy_bounds = [5e-2, 2e3] * u.TeV,
    ylim = [1e-15, 1e-9]
)
show_SED(
    datasets=analysis.datasets,
#     models=analysis.models,
    leg_style=leg_style,
    plot_limits=plot_limits)
```



[36]:
```
len(analysis.datasets)
```

[36]: 19

[37]:
```
config_settings = analysis.config
```

[38]:
```
datasets_analysis = [1,2,6,9,11,14,17,18]
```

[39]:
```
datasets = Datasets()
for index in datasets_analysis:
    datasets.append(analysis.datasets[index])
for index, dataset in enumerate(datasets):
    print(f"{index}: {dataset.name}")
```

```
0: HESS J1825-137: gamma-cat
1: HESS J1825-137: hgps
2: 4FGL J1824.4-1350e
3: 2FHL J1824.5-1350e
4: 3FHL J1824.5-1351e
5: HAWC J1825-138
6: eHWC J1825-134
7: LHAASO J1825-1326
```

[40]:
```
analysis.datasets = datasets
analysis.models = analysis.datasets.models
```

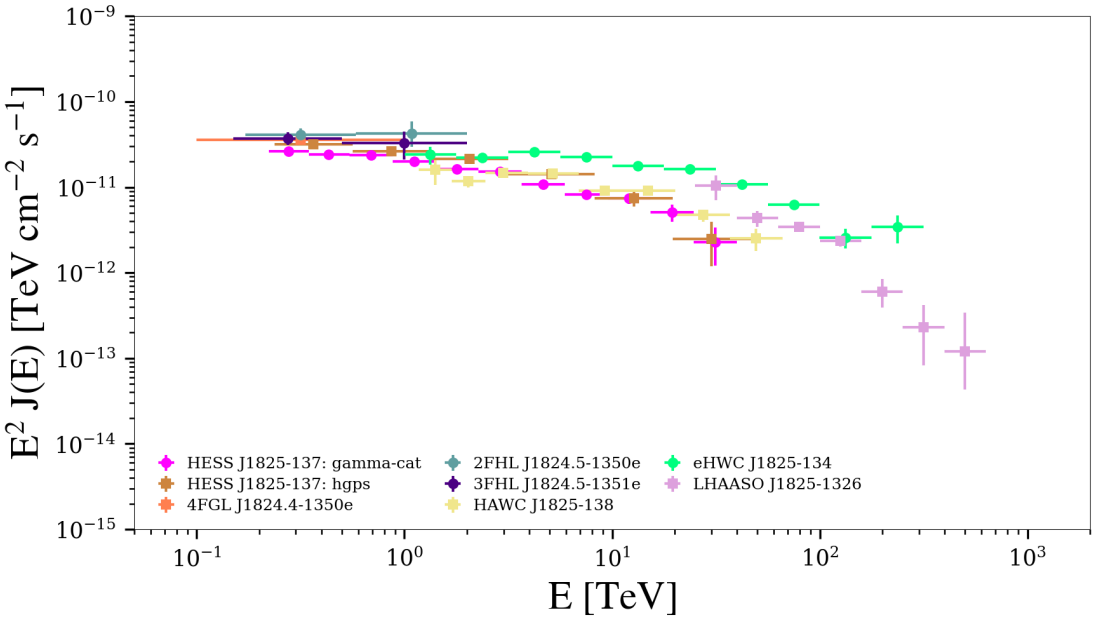
```
Reading model.
```

```
Models

Component 0: SkyModel

  Name                      : HESS_J1825-137_gamma-cat_ecpl
  Datasets names            : HESS J1825-137: gamma-cat
  Spectral model type       : ExpCutoffPowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                         :      2.260   +/-    0.03
    amplitude                     :   2.10e-11   +/- 5.0e-13 1 / (TeV s cm2)
    reference             (frozen):      1.000       TeV
    lambda_                       :      0.040   +/-    0.01 1 / TeV
    alpha                 (frozen):      1.000

Component 1: SkyModel

  Name                      : HESS_J1825-137_hgps_ecpl
  Datasets names            : HESS J1825-137: hgps
  Spectral model type       : ExpCutoffPowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                         :      2.151   +/-    0.06
    amplitude                     :   6.95e-11   +/- 2.9e-12 1 / (TeV s cm2)
    reference             (frozen):      0.650       TeV
    lambda_                       :      0.074   +/-    0.02 1 / TeV
    alpha                 (frozen):      1.000

Component 2: SkyModel

  Name                      : 4FGL_J1824.4-1350e_lp
  Datasets names            : 4FGL J1824.4-1350e
  Spectral model type       : LogParabolaSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    amplitude                     :   1.47e-13   +/- 8.0e-15 1 / (MeV s cm2)
    reference             (frozen):  11602.418       MeV
    alpha                         :      1.685   +/-    0.04
    beta                          :      0.047   +/-    0.02

Component 3: SkyModel

  Name                      : 2FHL_J1824.5-1350e_pl-2
  Datasets names            : 2FHL J1824.5-1350e
  Spectral model type       : PowerLaw2SpectralModel
```

```
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    amplitude                   :   7.15e-10   +/- 6.5e-11 1 / (s cm2)
    index                       :      1.890   +/-    0.11
    emin                (frozen):      0.050       TeV
    emax                (frozen):      2.000       TeV

Component 4: SkyModel

  Name                      : 3FHL_J1824.5-1351e_lp
  Datasets names            : 3FHL J1824.5-1351e
  Spectral model type       : LogParabolaSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    amplitude                   :   2.29e-11   +/- 1.9e-12 1 / (GeV s cm2)
    reference           (frozen):     33.405       GeV
    alpha                       :      1.527   +/-    0.10
    beta                        :      0.168   +/-    0.06

Component 5: SkyModel

  Name                      : HAWC_J1825-138_ecpl
  Datasets names            : HAWC J1825-138
  Spectral model type       : ExpCutoffPowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                       :      2.020   +/-    0.00
    amplitude                   :   2.70e-14   +/- 0.0e+00 1 / (TeV s cm2)
    reference           (frozen):     18.000       TeV
    lambda_                     :      0.037   +/-    0.00 1 / TeV
    alpha               (frozen):      1.000

Component 6: SkyModel

  Name                      : eHWC_J1825-134_ecpl
  Datasets names            : eHWC J1825-134
  Spectral model type       : ExpCutoffPowerLawSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    index                       :      2.120   +/-    0.00
    amplitude                   :   2.12e-13   +/- 0.0e+00 1 / (TeV s cm2)
    reference           (frozen):     10.000       TeV
    lambda_                     :      0.016   +/-    0.00 1 / TeV
    alpha               (frozen):      1.000
```

```
Component 7: SkyModel

  Name                      : LHAASO_J1825-1326_lp
  Datasets names            : LHAASO J1825-1326
  Spectral model type       : LogParabolaSpectralModel
  Spatial  model type       :
  Temporal model type       :
  Parameters:
    amplitude                     :   1.00e-12   +/- 0.0e+00 1 / (TeV s cm2)
    reference             (frozen):     10.000       TeV
    alpha                         :      0.920   +/-    0.00
    beta                          :      1.190   +/-    0.00
```

[41]:
```
show_SED(
    datasets=analysis.datasets,
    leg_style=leg_style,
    plot_limits=plot_limits)
```



[42]:
```
analysis.write_datasets(path_file=analysis_path)
```

[43]:
```
datasets = analysis.read_datasets(path_file=analysis_path)
```

```
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
```

```
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
No reference model set for FluxMaps. Assuming point source with E^-2 spectrum.
```

[ ]: