Tools for data analyses in Cosmology

- Aula 4 -

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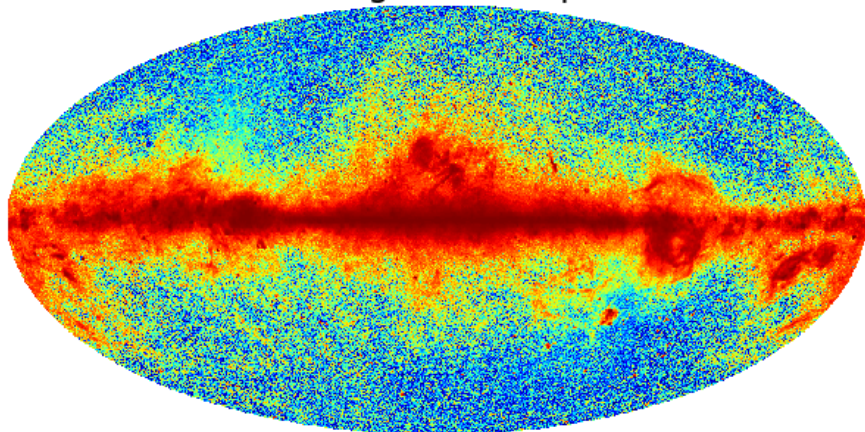
Observatório Nacional

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Healpy

Drawing a graticule on the current Axes

healpy.visufunc.graticule

`healpy.visufunc.graticule`(*dpar=None, dmer=None, coord=None, local=None, **kwds*)

Drawing a graticule on the current Axes

`How to use:`

```
In [21]: import healpy as hp
    ...:
    ...: mapa = hp.read_map('LFI_CompMap_Foregrounds-
smica_1024_R2.00.fits', field={0,1,2})
    ...:
    ...: hp.mollview(mapa[0], norm='hist', title='Including graticule
unit='K', coord=['G','E'])
    ...:
    ...: hp.graticule(dpar=10.,dmer=25.,coord=['G','E'], local=True)
    ...: |
```

- Plot a rotated a Mollweide projection and draw the graticule using the intervals of 25 degrees between meridians and 10 between parallels.

Result

Including graticule

Ecliptic

κ
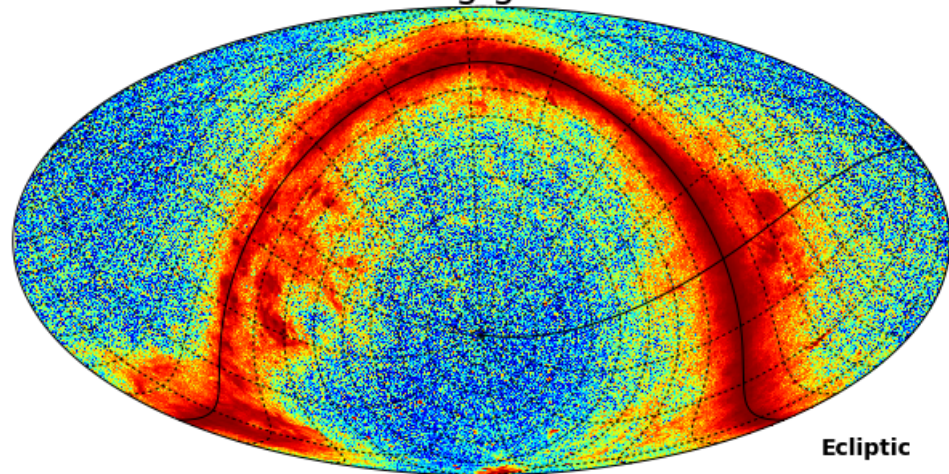
-0.000642212   0.163143

Visualizing a map in other projection types

healpy.visufunc.gnomview

healpy.visufunc.gnomview(*map=None, fig=None, rot=None, coord=None, unit='', xsize=200, ysize=None, reso=1.5, title='Gnomonic view', nest=False, remove_dip=False, remove_mono=False, gal_cut=0, min=None, max=None, flip='astro', format='%.3g', cbar=True, cmap=None, norm=None, hold=False, sub=None, margins=None, notext=False, return_projected_map=False*)

healpy.visufunc.cartview

healpy.visufunc.cartview(*map=None, fig=None, rot=None, zat=None, coord=None, unit='', xsize=800, ysize=None, lonra=None, latra=None, title='Cartesian view', nest=False, remove_dip=False, remove_mono=False, gal_cut=0, min=None, max=None, flip='astro', format='%.3g', cbar=True, cmap=None, norm=None, aspect=None, hold=False, sub=None, margins=None, notext=False, return_projected_map=False*)

healpy.visufunc.orthview

healpy.visufunc.orthview(*map=None, fig=None, rot=None, coord=None, unit='', xsize=800, half_sky=False, title='Orthographic view', nest=False, min=None, max=None, flip='astro', remove_dip=False, remove_mono=False, gal_cut=0, format='%g', format2='%g', cbar=True, cmap=None, notext=False, norm=None, hold=False, margins=None, sub=None, return_projected_map=False*)

Visualizing a map in other projection types
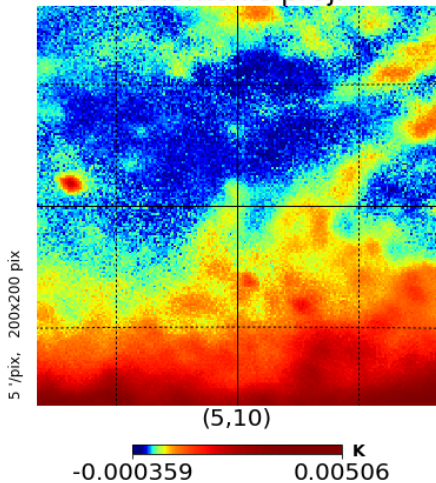
```
In [66]: hp.gnomview(mapa[0],rot=[5,10,0], title='Gnomonic proj.',
reso=5., nest=True, norm='hist', unit='K')
    ...: hp.graticule(dpar=5., local=True)
    ...:
    ...: hp.cartview(mapa[0], nest=True, norm='hist', unit='K')
    ...: hp.graticule(dpar=10.,dmer=25.)
    ...:
    ...: hp.orthview(mapa[0], nest=True, norm='hist', unit='K')
    ...: hp.graticule(dpar=10.,dmer=25.)
    ...:
```
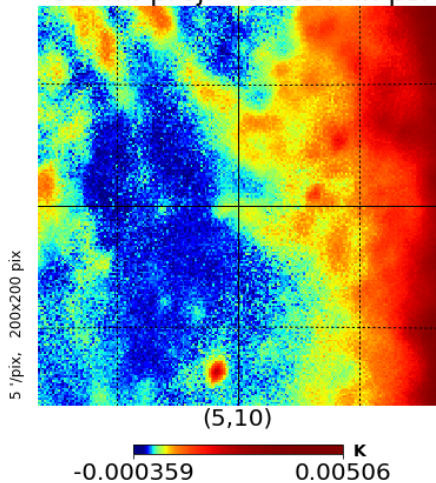
Exercise

- Visualize the map in **Gnomonic** projection.
  Consider:
  - Centralized at l,b = (5,10) degrees (use "rot=[5,10,0]").
  - Resolution of 5 arcmin.
  - Rotate of 90 degree in psi (use "rot=[5,10,90]").
  - Galactic coordinates,

- Visualize the map in **Cartesian**, and **Orthographic**
  projections.
  Consider:
  - Galactic coordinates,
  - Repeat projections changing to Ecliptic coordinates.

- Include graticule in all of them.
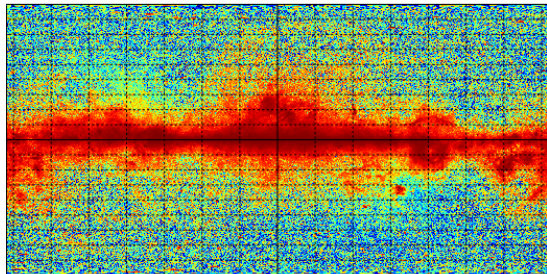
Results

Gnomonic proj.

Gnom. proj.- rotation in psi
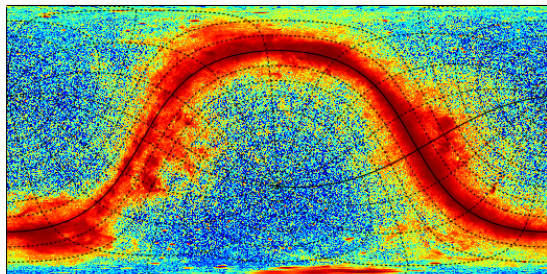
5 '/pix, 200x200 pix

(5,10)

κ

-0.000359   0.00506

5 '/pix, 200x200 pix

(5,10)

κ

-0.000359   0.00506

Results

Cartesian view

κ

-0.000619   0.215

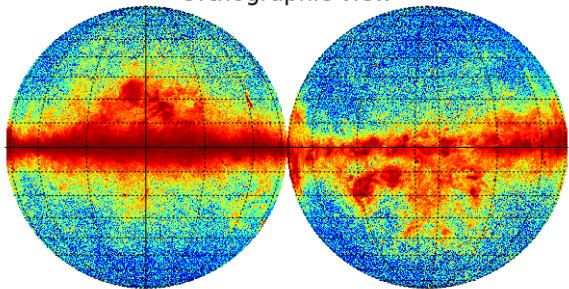Cartesian view

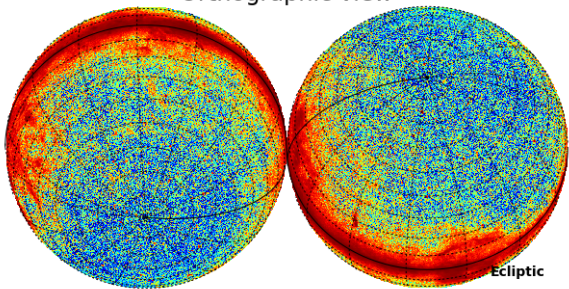Ecliptic

Results

Orthographic view

-0.000634265   K   0.213553

Orthographic view

Ecliptic

-0.000612068   K   0.096441

Writing a healpix map into a healpix file

healpy.fitsfunc.write_map

`healpy.fitsfunc.write_map`(*filename, m, nest=False, dtype=<type 'numpy.float32'>, fits_IDL=True, coord=None, partial=False, column_names=None, column_units=None, extra_header=()*)

Writing a healpix map into a healpix file

Before ...

```
camila@cosmo: $ conda list
```

Verify if your version of Astropy is 1.2.1.
If not ...

```
camila@cosmo:~$ conda update conda
camila@cosmo:~$ conda install -c anaconda astropy=1.2.1
```

Writing a healpix map into a healpix file

```
In [66]: mapa[0][:] = mapa[0][:] * 1e6
    ...:
    ...: hp.write_map('new_map.fits',mapa, coord='G',
column_names=list(['30GHz','44GHz','70GHz']),
column_units=list(['microK','K','K']))
    ...:
    ...: mapa2 = hp.read_map('new_map.fits', field={0,1,2}, h=True)
    ...: |
```

Exercise:

○ Read the file and verify if it was correctly saved and if the header has the information you included.

Reading/Writing generic data of/into a fits file

healpy.fitsfunc.mrdfits

`healpy.fitsfunc.mrdfits(filename, hdu=1)`

healpy.fitsfunc.mwrfits

`healpy.fitsfunc.mwrfits(filename, data, hdu=1, colnames=None, keys=None)`

Reading/Writing generic data of/into a fits file

How to use:

```python
In [101]: data = hp.mrdfits('COM_PCCS_030_R2.04.fits')

In [102]: ## OU AINDA:
     ...:
     ...: from astropy.io import fits
     ...:
     ...: hdulist = fits.open('COM_PCCS_030_R2.04.fits')
     ...: hdulist.info()
     ...: data = hp.mrdfits(hdulist, hdu=1)
     ...:
     ...: hdulist.writeto('new_table2.fits')
```

Reading/Writing generic data of/into a fits file

How to use:

```
In [95]: import pyfits
    ...:
    ...: x = data[10]
    ...: hdu = pyfits.PrimaryHDU(x)
    ...: hdulist = pyfits.HDUList([hdu])
    ...: hdulist.writeto('new.fits')
    ...: hdulist.close()
    ...:
    ...: hdulist = pyfits.open('new.fits')
    ...: data2 = hdulist[0].data
    ...:
```