radial_profiles_code

June 30, 2022

[ ]:
```
import numpy as np
import matplotlib.pyplot as plt
from astropy.io import fits

xnew = np.linspace(-6, 6, 301)
ynew = np.linspace(-6, 6, 301)

xnew, ynew = np.meshgrid(xnew, ynew)

from matplotlib.ticker import AutoMinorLocator

minorLocator = AutoMinorLocator()


def radial_profile(data, center):
    x, y = np.indices((data.shape))
    r = np.sqrt((x - center[0])**2 + (y - center[1])**2)
    r = r.astype(int)

    tbin = np.bincount(r.ravel(), data.ravel())
    nr = np.bincount(r.ravel())
    radialprofile = tbin / nr
    return radialprofile


fitsFile = fits.open('ILC_stack_spiders_seed_162_70-545.fits')
img = fitsFile[0].data
img[np.isnan(img)] = 0

center = np.unravel_index(img.argmax(), img.shape)
#center = (-fitsFile[0].header['LBOUND2']+1, -fitsFile[0].header['LBOUND1']+1)
rad_profile = radial_profile(img, center)

fig, ax = plt.subplots()
plt.plot(rad_profile[0:150], 'x-')

ax.xaxis.set_minor_locator(minorLocator)
```

```
plt.tick_params(which='both', width=2)
plt.tick_params(which='major', length=7)
plt.tick_params(which='minor', length=4, color='r')
plt.grid()
#ax.set_ylabel(fitsFile[0].header['Label'] + " (" + fitsFile[0].header['BUNIT']␣
 ↪+ ")")
ax.set_xlabel("Pixels")
plt.grid(which="minor")
plt.show()
```

[ ]:
```
hdul = fits.open('ILC_stack_spiders_seed_162_70-545.fits')
```

[ ]:
```
hdul.info()
```

```
Filename: ILC_stack_spiders_seed_162_70-545.fits
No.    Name      Ver    Type      Cards   Dimensions   Format
  0  PRIMARY       1 PrimaryHDU      13   (301, 301)   float64
```

[ ]:
```
hdr = hdul[0].header

print(repr(hdr))

print(-hdul[0].header['BITPIX']+1)
```

```
SIMPLE  =                    T / conforms to FITS standard
BITPIX  =                  -64 / array data type
NAXIS   =                    2 / number of array dimensions
NAXIS1  =                  301
NAXIS2  =                  301
EXTEND  =                    T
NGAL    = '45      '
FSKY    = '86 percent'
YSZ     = 'planck  '
ILCSTART= '70      '
ILCSTOP = '545     '
WEIGHTS = '[[-0.0010 -0.0090 -0.2775 0.2633 0.0294 -0.0031]]'
DATE    = '16-2-2022'
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```

[ ]:
```
import numpy as np

# Set up matplotlib
import matplotlib.pyplot as plt
%matplotlib inline

from astropy.io import fits
```

[ ]:
```
hdu_list = fits.open('ILC_stack_spiders_seed_162_70-545.fits')
hdu_list.info()
```

```
Filename: ILC_stack_spiders_seed_162_70-545.fits
No.    Name      Ver    Type      Cards   Dimensions   Format
  0  PRIMARY       1 PrimaryHDU      13   (301, 301)   float64
```

[ ]:
```
image_data = hdu_list[0].data
```

[ ]:
```
print(type(image_data))
print(image_data.shape)
```

```
<class 'numpy.ndarray'>
(301, 301)
```

[ ]:
```
image_data = fits.getdata('ILC_stack_spiders_seed_162_70-545.fits')
```

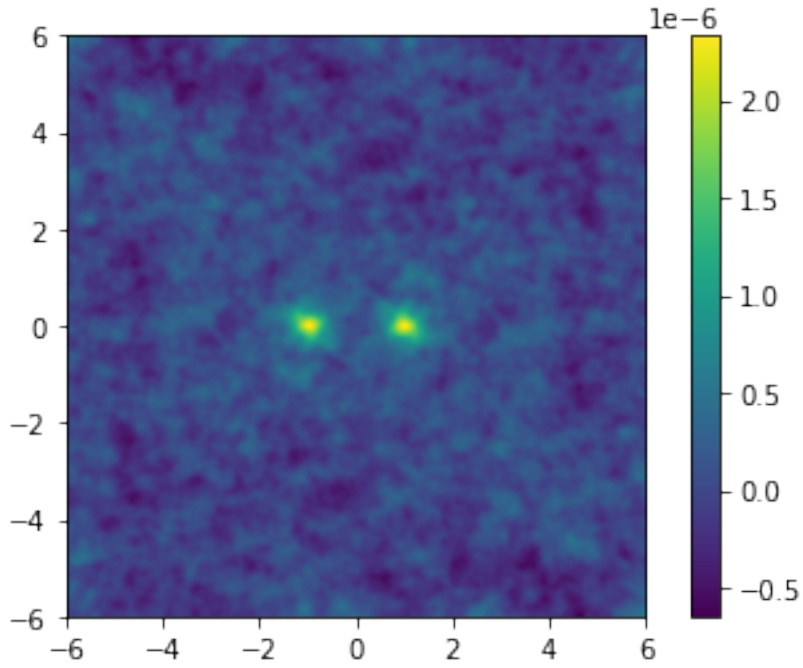
[ ]:
```
print(type(image_data)) # Show the Python type for image_data
print(image_data.shape) # Show the number of pixels per side in the 2-D image
```

```
<class 'numpy.ndarray'>
(301, 301)
```

[ ]:
```
xnew = np.linspace(-6, 6, 301)
ynew = np.linspace(-6, 6, 301)

xnew, ynew = np.meshgrid(xnew, ynew)
#plt.imshow(image_data)
plt.imshow(image_data,extent=[-6,6,-6,6])
#plt.grid()
plt.colorbar()
```

[ ]: <matplotlib.colorbar.Colorbar at 0x7fb101c73880>



[ ]:
```
def radial_profile(data, center):
    y,x = np.indices((data.shape)) # first determine radii of all pixels
    r = np.sqrt((x-center[0])**2+(y-center[1])**2)
    ind = np.argsort(r.flat) # get sorted indices
    sr = r.flat[ind] # sorted radii
    sim = data.flat[ind] # image values sorted by radii
    ri = sr.astype(np.int32) # integer part of radii (bin size = 1)
    # determining distance between changes
    deltar = ri[1:] - ri[:-1] # assume all radii represented
    rind = np.where(deltar)[0] # location of changed radius
    nr = rind[1:] - rind[:-1] # number in radius bin
    csim = np.cumsum(sim, dtype=np.float64) # cumulative sum to figure out sums␣
 ↪for each radii bin
    tbin = csim[rind[1:]] - csim[rind[:-1]] # sum for image values in radius␣
 ↪bins
    radialprofile = tbin/nr # the answer
    return radialprofile

img = plt.imread('ILC_stack_spiders_seed_162_70-545.fits', 0)
# center, radi = find_centroid(img)
center, radi = (0, 0), 55
rad = radial_profile(img, center)

plt.plot(rad[radi:])
plt.show()
```

[ ]:
```
from astropy.io import fits
import numpy as np
import matplotlib.pyplot as plt
from matplotlib.ticker import AutoMinorLocator

minorLocator = AutoMinorLocator()


def radial_profile(data, center):
    x, y = np.indices((data.shape))
    r = np.sqrt((x - center[0])**2 + (y - center[1])**2)
    r = r.astype(int)

    tbin = np.bincount(r.ravel(), data.ravel())
    nr = np.bincount(r.ravel())
    radialprofile = tbin / nr
    return radialprofile


fitsFile = fits.open('ILC_stack_spiders_seed_162_70-545.fits')
img = fitsFile[0].data
img[np.isnan(img)] = 0
#print(img[125][125])

#print(img[150])
#center = np.unravel_index(img.argmax(), img.shape)
#center = (img[150][])
center = (150+1, 150+1)
rad_profile = radial_profile(img, center)
print(len(rad_profile))
print(rad_profile)
fig, ax = plt.subplots()
plt.plot(rad_profile[0:55], 'x-')

ax.xaxis.set_minor_locator(minorLocator)

plt.tick_params(which='both', width=2)
plt.tick_params(which='major', length=7)
plt.tick_params(which='minor', length=4, color='r')
plt.grid()
#ax.set_ylabel(fitsFile[0].header['Label'] + " (" + fitsFile[0].header['BUNIT']␣
 ↪+ ")")
ax.set_xlabel("Pixels")
plt.grid(which="minor")
plt.show()
```

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```
[ 3.81188975e-08  3.10266419e-08  3.50512725e-08  3.96073374e-08
  6.16837633e-08  8.64392356e-08  1.30528855e-07  1.67518722e-07
  2.10292879e-07  2.44123717e-07  2.75725537e-07  3.09758076e-07
  3.38514225e-07  3.69478745e-07  4.06933491e-07  4.34615021e-07
  4.71383927e-07  4.86811021e-07  5.15712751e-07  5.09103040e-07
  5.05513271e-07  4.78974640e-07  5.03018718e-07  5.23606431e-07
  5.13084904e-07  5.19538315e-07  4.92561374e-07  4.87666462e-07
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  3.49050860e-07  3.15774226e-07  2.91187536e-07  2.87484190e-07
  2.76613336e-07  2.59863282e-07  2.50120900e-07  2.42392483e-07
  2.44262223e-07  2.49891008e-07  2.37455259e-07  2.27129968e-07
  2.06211443e-07  1.78856366e-07  1.43885718e-07  1.15469859e-07
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  1.46328978e-08  9.89860746e-09  4.92752327e-09  7.14199198e-09
  9.24640666e-09  1.60327636e-08  2.58719354e-08  2.28002184e-08
  3.49553858e-08  3.49754359e-08  3.42476919e-08  3.36450470e-08
  2.34715287e-08  1.27456085e-08  3.73420825e-10 -6.47460944e-09
 -9.49137965e-09 -1.30836571e-08 -1.48149238e-08 -1.61379420e-08
 -1.56382358e-08 -1.41051368e-08  7.38347078e-10  1.61323143e-08
  2.79355224e-08  5.34754883e-08  5.05657713e-08  5.12350768e-08
  4.30286569e-08  3.06208821e-08  3.11601541e-08  2.75252484e-08
  3.29868423e-08  3.26732395e-08  3.55332246e-08  3.22594982e-08
  3.02991162e-08  2.96729183e-08  2.52952112e-08  2.67184870e-08
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  2.53866934e-08  1.92668251e-08  1.27236420e-08  8.62550624e-09
  6.22529285e-09 -6.76730875e-10 -3.04374653e-09 -7.91930698e-09
 -1.03210286e-08 -1.86895457e-08 -1.65006347e-08 -2.66976580e-08
 -3.36111046e-08 -4.10427213e-08 -5.67593090e-08 -6.69726031e-08
 -6.96706733e-08 -8.18858038e-08 -7.53526777e-08 -8.11106430e-08
 -7.37474932e-08 -6.18304929e-08 -5.77399121e-08 -3.42914895e-08
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 -5.16461459e-08 -4.78121419e-08 -3.61359985e-08 -3.16686893e-08
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 -8.05995209e-09 -5.56326795e-09 -1.55986345e-08 -1.87533466e-08
 -2.54065924e-08 -2.94603138e-08 -2.80502374e-08 -3.09958125e-08
 -3.62573622e-08 -3.98660934e-08 -4.93956608e-08 -4.17313050e-08
 -5.18536445e-08 -4.22023801e-08 -4.49421623e-08 -5.24380553e-08
 -4.30259222e-08 -5.23467739e-08 -5.86016161e-08 -8.23825814e-08
 -1.01833089e-07 -9.62294921e-08 -1.26034535e-07 -1.16702051e-07
 -1.24298682e-07 -1.16702727e-07 -1.16846867e-07 -1.20365324e-07
 -1.15132358e-07 -1.17191808e-07 -1.16799575e-07 -1.06839513e-07
 -1.03353022e-07 -1.09603595e-07 -9.78122231e-08 -1.09645304e-07
 -9.43220322e-08 -9.85864564e-08 -9.57960491e-08 -8.28198806e-08
 -8.42876592e-08 -8.03807334e-08 -7.98443539e-08 -8.72640432e-08
```
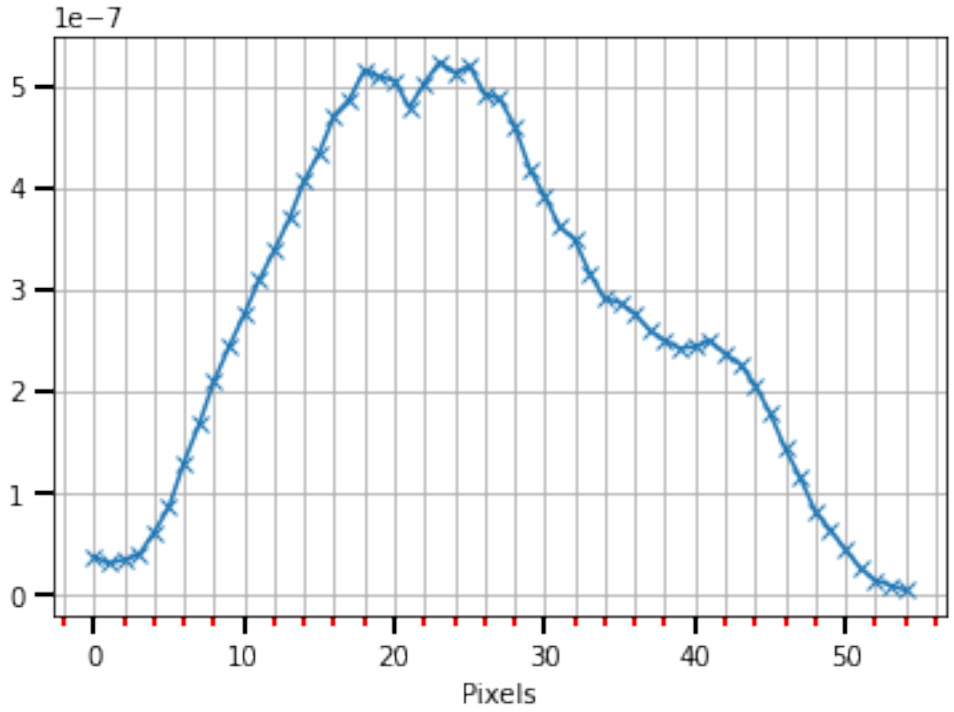

```
-7.64686003e-08 -5.64332178e-08 -4.34390555e-08 -2.44720463e-08
-1.00523597e-08  5.14504262e-10  5.43070412e-08  6.76151730e-08
 1.23959096e-07  1.48598533e-07  1.59344366e-07  1.79805427e-07
 1.83850918e-07  1.81540876e-07  1.78444223e-07  1.81530283e-07
 1.83334850e-07  1.86460952e-07  2.14974788e-07  2.61481066e-07
 3.99676522e-07  5.72657900e-07]
```



[ ]:
```
!export PATH=/Library/TeX/texbin:$PATH
```

[ ]:
```

```