In [71]:
```
import glob

from astropy import units as u
from astropy.io import fits
import numpy as np
import matplotlib.pyplot as plt
```

In [23]:
```
files=glob.glob('*.fits')
files_osr=[line.rstrip('\n') for line in open('files_osr.list')]
```

In [26]:
```
n=len(files)

for i in range(0,n):
    data=fits.getdata(files[i])
    new_data=data[350:1650,350:1650]
    fits.writeto(files_osr[i],new_data)
```

In [31]:
```
biasfiles=glob.glob('osr_*bias*')
biasfiles
```

Out[31]:
```
['osr_arctic_bias.0001.fits',
 'osr_arctic_bias.0002.fits',
 'osr_arctic_bias.0003.fits',
 'osr_arctic_bias.0004.fits',
 'osr_arctic_bias.0005.fits']
```

In [32]:
```
data_stack = []
for file in biasfiles:
    data_stack.append(fits.getdata(file))

medianBias = np.median(data_stack,axis=0)

header = fits.getheader(biasfiles[0])

header['HISTORY'] = 'Median combined'
```

In [33]:
```
datafilesin = [line.rstrip('\n') for line in open('files_without_bias.list')]
datafilesout = [line.rstrip('\n') for line in open('files_subtracted_bias.lis
t')]


n = len(datafilesin)

for i in range(0,n):
    data = fits.getdata(datafilesin[i],header=False)
    dataout = data - medianBias
   # header['HISTORY'] = 'Bias subtracted'
    fits.writeto(datafilesout[i],dataout)
```

In [34]:
```
flatfiles_r=[line.rstrip('\n') for line in open('flats_r.list')]
```

In [35]:
```
r_flat_stack = []
for file in flatfiles_r:
    data = fits.getdata(file,header=False)
    data = data / np.median(data)
    r_flat_stack.append(data)
```

In [36]:
```
r_flat=np.median(r_flat_stack,axis=0)
m=np.mean(r_flat)
r_flat_avg=r_flat/m

header['HISTORY'] = 'Combined and normalized flat field'
fits.writeto('r_flat_avg.fits',r_flat_avg,header)
```

In [1]:
```
r_datain = [line.rstrip('\n') for line in open('r_data.list')]
r_dataout = [line.rstrip('\n') for line in open('r_data_out.list')]
```

In [38]:
```
n=len(r_datain)

for i in range(0,n):
    data = fits.getdata(r_datain[i],header=False)
    dataout = data / r_flat_avg
    fits.writeto(r_dataout[i],dataout)
```

In [2]:
```
from astropy.io import fits
import numpy as np
import glob
import matplotlib.pyplot as plt
from photutils import CircularAperture as ca
from photutils import CircularAnnulus as can
from photutils import aperture_photometry
import photutils
from matplotlib.colors import LogNorm
```

In [3]:
```
r_ap=483
r_in=485
r_out=490

x=621;y=632
position =[(x,y)]
aperture = ca(position,r_ap)
Annulus_aperatures = can(position, r_in,r_out)
r_dataout
```

Out[3]:
```
['no_bias_flatted_arctic_m97.0001.fits',
 'no_bias_flatted_arctic_m97.0002.fits']
```

In [145]:
```
image_data=fits.getdata(r_dataout[0])
aperature_values=aperture_photometry(image_data,Annulus_aperatures,method=
'center')
mean_background=aperature_values['aperture_sum']/Annulus_aperatures.area()
mean_background
a=np.ones((1300,1300))
background = a*mean_background

new_image = image_data-background

fits.writeto('no_bias_flatted_arctic_m97.0001.fits',new_image)
```

Out[145]:
```
array([[1073.05437218, 1073.05437218, 1073.05437218, ..., 1073.05437218,
        1073.05437218, 1073.05437218],
       [1073.05437218, 1073.05437218, 1073.05437218, ..., 1073.05437218,
        1073.05437218, 1073.05437218],
       [1073.05437218, 1073.05437218, 1073.05437218, ..., 1073.05437218,
        1073.05437218, 1073.05437218],
       ...,
       [1073.05437218, 1073.05437218, 1073.05437218, ..., 1073.05437218,
        1073.05437218, 1073.05437218],
       [1073.05437218, 1073.05437218, 1073.05437218, ..., 1073.05437218,
        1073.05437218, 1073.05437218],
       [1073.05437218, 1073.05437218, 1073.05437218, ..., 1073.05437218,
        1073.05437218, 1073.05437218]])
```

In [4]:
```
image_data=fits.getdata(r_dataout[1])
aperature_values=aperture_photometry(image_data,Annulus_aperatures,method='cen
ter')
mean_background=aperature_values['aperture_sum']/Annulus_aperatures.area()
mean_background
a=np.ones((1300,1300))
background = a*mean_background

new_image = image_data-background

fits.writeto('no_bias_flatted_arctic_m97.0002.fits',new_image)
```