

AST443 HW3

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1 Tutorial 4

From the header of the science image we find the exposure time to be 2.00 seconds and the gain to be 2.06 e. Looking at the stats from the dark frames, we found that they each had equal exposure time and gain, so all dark frames would be used in creating the masterdark.

1.1 SExConfig File

```
# Default configuration file for SExtractor 2.19.5
```

```
# EB 2014-03-19
```

```
#
```

```
#----- Catalog -----
```

```
CATALOG_NAME      test.cat      # name of the output catalog
CATALOG_TYPE       ASCII_HEAD    # NONE,ASCII,ASCII_HEAD, ASCII_SKYCAT,
                                # ASCII_VOTABLE, FITS_1.0 or FITS_LDAC
PARAMETERS_NAME    default.param # name of the file containing catalog contents
```

```
#----- Extraction -----
```

```
DETECT_TYPE        CCD           # CCD (linear) or PHOTO (with gamma correction)
DETECT_MINAREA      5            # min. # of pixels above threshold
DETECT_THRESH       1.5          # <sigmas> or <threshold>,<ZP> in mag.arcsec-2
ANALYSIS_THRESH     1.5          # <sigmas> or <threshold>,<ZP> in mag.arcsec-2

FILTER              Y            # apply filter for detection (Y or N)?
FILTER_NAME         default.conv  # name of the file containing the filter

DEBLEND_NTHRESH     32           # Number of deblending sub-thresholds
DEBLEND_MINCONT     0.005        # Minimum contrast parameter for deblending

CLEAN                Y           # Clean spurious detections? (Y or N)?
CLEAN_PARAM         1.0          # Cleaning efficiency
```

MASK_TYPE	CORRECT	# type of detection MASKing: can be one of # NONE, BLANK or CORRECT
#----- Photometry -----		
PHOT_APERTURES	5	# MAG_APER aperture diameter(s) in pixels
PHOT_AUTOPARAMS	2.5, 3.5	# MAG_AUTO parameters: <Kron_fact>,<min_radius>
PHOT_PETROPARAMS	2.0, 3.5	# MAG_PETRO parameters: <Petrosian_fact>, # <min_radius>
SATUR_LEVEL	50000.0	# level (in ADUs) at which arises saturation
SATUR_KEY	SATURATE	# keyword for saturation level (in ADUs)
MAG_ZEROPOINT	0.0	# magnitude zero-point
MAG_GAMMA	4.0	# gamma of emulsion (for photographic scans)
GAIN	2.06	# detector gain in e-/ADU
GAIN_KEY	GAIN	# keyword for detector gain in e-/ADU
PIXEL_SCALE	1.0	# size of pixel in arcsec (0=use FITS WCS info)
#----- Star/Galaxy Separation -----		
SEEING_FWHM	1.2	# stellar FWHM in arcsec
STARNNW_NAME	default.nnw	# Neural-Network_Weight table filename
#----- Background -----		
BACK_SIZE	64	# Background mesh: <size> or <width>,<height>
BACK_FILTERSIZE	3	# Background filter: <size> or <width>,<height>
BACKPHOTO_TYPE	GLOBAL	# can be GLOBAL or LOCAL
#----- Check Image -----		
CHECKIMAGE_TYPE	NONE	# can be NONE, BACKGROUND, BACKGROUND_RMS, # MINIBACKGROUND, MINIBACK_RMS, -BACKGROUND, # FILTERED, OBJECTS, -OBJECTS, SEGMENTATION, # or APERTURES
CHECKIMAGE_NAME	check.fits	# Filename for the check-image
#----- Memory (change with caution!) -----		
MEMORY_OBJSTACK	3000	# number of objects in stack
MEMORY_PIXSTACK	300000	# number of pixels in stack
MEMORY_BUFSIZE	1024	# number of lines in buffer

```
#----- Miscellaneous -----

VERBOSE_TYPE      NORMAL          # can be QUIET, NORMAL or FULL
HEADER_SUFFIX     .head           # Filename extension for additional headers
WRITE_XML         N               # Write XML file (Y/N)?
XML_NAME          sex.xml         # Filename for XML output
```

1.2 Catalog Overlaid on Image

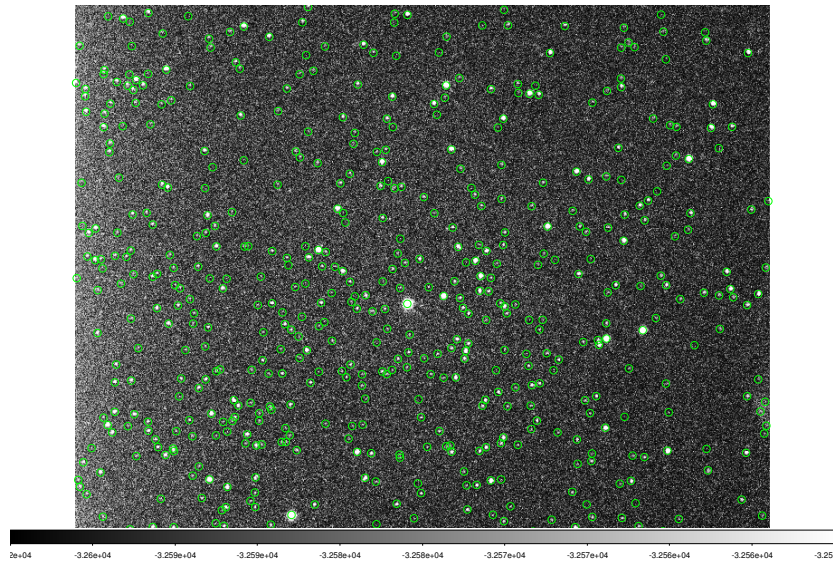


Figure 1: Object Catalog Overlaid on Science Image

1.3 Masterdark

1.4 Bash and PyRaf Commands

```
1 ds9
2 vim .bashhrc
3 vim .bashrc
4 ${HOME}/.bashrc
5 ~/.bashrc
6 exit
7 ds9
8 exit
9 ds9
10 exit
11 cd /astrolab/anja/PHY517_AST443_archive/TRANSITS/HD189733_2016-10-10/
```

```

12 lsw
13 ls
14 cp hd189733.00002 /astrolab/Fall_18/mflament/
15 cp darks.000026* /astrolab/Fall_18/mflament/
16 cp flats.0000* /astrolab/Fall_18/mflament/
17 cd /astrolab/Fall_18/mflament/
18 ls
19 rm *.NOAUTO*
20 ls
21 more hd189733.00000127.FIT
22 clear
23 more hd189733.00000127.FIT
24 clear
25 ls
26 ds9 hd189733.00000127.FIT
27 exit
28 cd /astrolab/anja/PHY517_AST443_
29 cd /astrolab/anja/PHY517_AST443_archive/
30 ls
31 ls /astrolab/anja/PHY517_AST443_archive/TRANSITS
32 ls /astrolab/anja/PHY517_AST443_archive/TRANSITS/HD189733_2016-10-10
33 passwd
34 ls /astrolab/anja/
35 ls /astrolab/anja/PHY517_AST443_archive/
36 ls -s /astrolab/anja/
37 ls -l /astrolab/anja/
38 ls /astrolab/anja/PHY517_AST443_archive
39 ls /astrolab/anja/PHY517_AST443_archive/TRANSITS/
40 ls /astrolab/anja/PHY517_AST443_archive/TRANSITS/HD189733_2016-10-10/
41 ls /astrolab/anja/PHY517_AST443_archive/TRANSITS/HD189733_2016-10-10/
42 cd /astrolab/anja/PHY517_AST443_archive/TRANSITS/HD189733_2016-10-10/
43 ssh uhura
44 ssh -X uhura
45 cd /astrolab/Fall_18/mflament/
46 ls
47 ds9 hd189733.00000127.FIT
48 dfits
49 dfits darks.000026*
50 dfits darks.000026* |grep GAIN
51 dfits darks.000026* |grep EXP
52 ls
53 fitsort
54 fitsort darks.000026*
55 dfits darks.000026* |grep EXP
56 dfits darks.000026* |grep GAIN
57 ls

```

```

58 dfits hd189733.00000127.FIT
59 dfits darks.000026* |grep GAIN
60 ds9 hd189733.00000127.FIT
61 solve-field --ra 20,00,43.71 --dex 22,42,39.07
62 solve-field -help
63 solve-field --ra 20:00:43.71 --dex 22:42:39.07 hd189733.00000127.FIT
64 solve-field --ra 20:00:43.71 --dex 22:42:39.07 --r 1 hd189733.00000127.FIT
65 solve-field --ra 20:00:43.71 --dec 22:42:39.07 --r 1 hd189733.00000127.FIT
66 solve-field --ra 20:00:43.71 --dec 22:42:39.07 --radius 1 hd189733.00000127.FIT
67 ls
68 nautilus ./
69 solve-field --ra 20:00:43.71 --dec 22:42:39.07 --radius 4 hd189733.00000127.FIT
70 solve-field --ra 20:00:43.71 --dec 22:42:39.07 --radius 0.5 hd189733.00000127.FIT
71 mv hd189733.00000127.FIT xhd189733.00000127.FIT
72 rm hd189733.00000127*
73 mv xhd189733.00000127.FIT hd189733.00000127.FIT
74 solve-field --ra 20:00:43.71 --dec 22:42:39.07 --radius 0.5 hd189733.00000127.FIT
75 nautilus ./
76 cd /astrolab/Fall_18/mflament/
77 ls
78 nautlis ./
79 nautilus ./
80 exit
81 cd /astrolab/Fall_18/mflament/
82 ls
83 nautilus ./
84 ds9 hd189733.00000127* &
85 sex -d
86 ls
87 sex -d > sexconfig
88 vim sexconfig
89 sex hd189733.00000127.new -c sexconfig
90 sex -dp > default.param
91 sex hd189733.00000127.new -c sexconfig
92 sex -dd > test
93 more test
94 ls
95 rm test
96 wget github.com/anjavdl/PHY517_AST443/blob/master/exoplanet/default.se
97 wget github.com/anjavdl/PHY517_AST443/blob/master/exoplanet/default.param
98 rm default.param*
99 wget github.com/anjavdl/PHY517_AST443/blob/master/exoplanet/default.param
100 more default.param
101 rm default.*
102 wget raw.githubusercontent.com/anjavdl/PHY517_AST443/blob/master/exoplanet/default.p
103 wget https://raw.githubusercontent.com/anjavdl/PHY517_AST443/blob/master/exoplanet/d

```

```
104 wget https://raw.githubusercontent.com/anjavdl/PHY517_AST443/master/exoplanet/default
105 more default.param
106 ls
107 rm default.param
108 wget https://raw.githubusercontent.com/anjavdl/PHY517_AST443/master/exoplanet/default
109 wget https://raw.githubusercontent.com/anjavdl/PHY517_AST443/master/exoplanet/default
110 wget https://raw.githubusercontent.com/anjavdl/PHY517_AST443/master/exoplanet/default
111 wget https://raw.githubusercontent.com/anjavdl/PHY517_AST443/master/exoplanet/default
112 ls
113 sex hd189733.00000127.new -c sexconfig
114 ls
115 more test.cat
116                ls
117 ds9 hd189733.00000127.new
118 nautilus ./
119 clear
120 ls
121 pyraf
122 iraf
123 pyraf
124 ls
125 mv pyraf/ old
126 mkdir iraf
127 cd iraf/
128 ls
129 mkiraf
130 ls
131 iraf
132 pyraf
133 ls
134 cd ..
135 ls
136 pyraf
137 cd iraf/
138 ls
139 ls *
140 cd ..
141 cd iraf/
142 pyraf
143 ls
144 cd ..
145 ls
146 mkdir test
147 cp darks.000026* test
148 cd test/
149 ls
```

```

150 rename 's/.FIT/.fits/g' ./darks*
151 ls
152 rename 's/.FIT/.fits/g' *
153 ls
154 rename 's/FIT/fits/g' *
155 ls
156 rename help
157 rename -h
158 rename -help
159 rename s/FIT/fits/g *
160 ls
161 rename FIT fits darks.000026*
162 ls
163 cd ..
164 ls
165 cd iraf/
166 ls
167 pyraf
168 ls
169 ls ../test/darks.000026
170 ls ../test/
171 ls
172 pyraf
173 ls
174 cp median_dark.fits ..
175 pyraf
176 ls
177 cd ..
178 ls
179 cp hd189733.00000127.new new.fit
180 cd iraf/
181 pyraf
182 cd ..
183 ls
184 cd iraf/
185 ls
186 mv yay.fit outputsubtracted.fit
187 ds9 outputsubtracted.fit
188 ds9 outputsubtracted.fit ../new.fit
189 history > history.txt

imcombine ../test/dark* median_dark.fits combine=median
imarith ../new.fit - median_dark.fits yay.fit
.exit

```

1.4.1 Dark-corrected Image

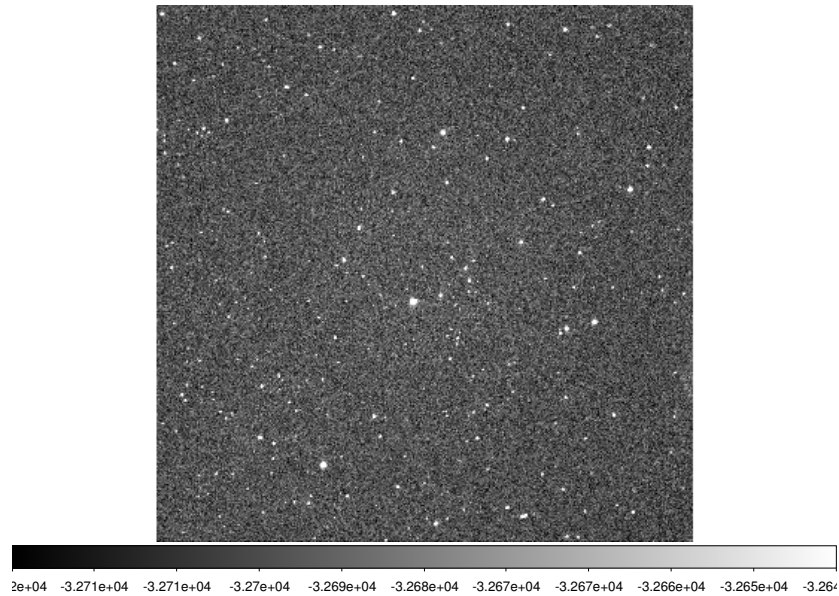


Figure 2: Dark-corrected Science Image (zscale)

1.5 Masterflat

```
ftpixcalc masterflat.fits "(a+b+c+d+e+z+g+h+i)/9" a=flats.00000001.FIT  
b=flats.00000002.FIT c=flats.00000003.FIT d=flats.00000004.FIT  
e=flats.00000005.FIT z=flats.00000006.FIT g=flats.00000007.FIT  
h=flats.00000008.FIT i=flats.00000009.FIT >masterflatcmd.txt
```

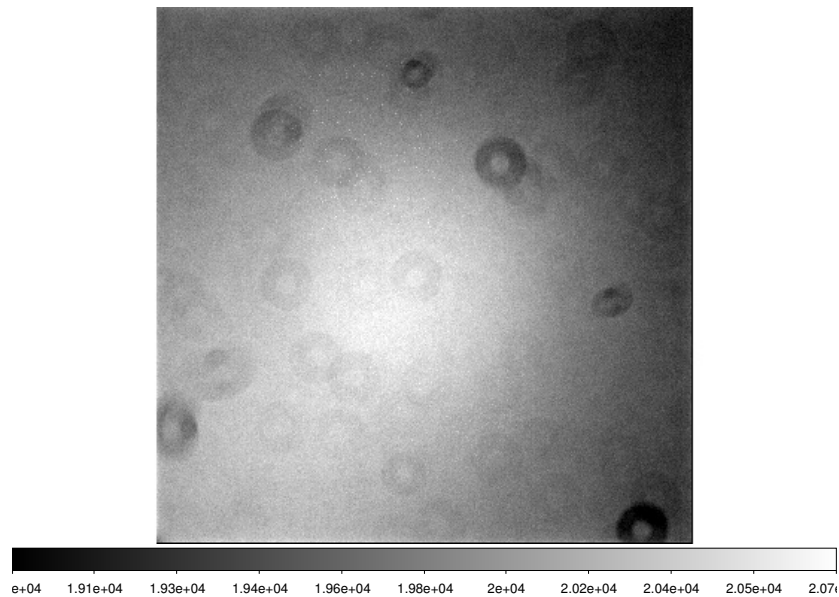



Figure 3: Masterflat (zscale)

1.6 Stats for Masterdark Without and With 5σ Clipping

```
[mflament@uhura mflament]$ more wocliping_masterdark
===== statistics for iraf/median_dark.fits =====

      extname:  PRIMARY
minimum value:  96.500000
      pixel coord:  (506,88)
maximum value: 11064
      pixel coord:  (199,496)
          mean: 106.7587337
          median: 106
          sigma: 11.91201114
          sum: 111944646
#good pixels: 1048576
#null pixels: 0
          mode: 105
          modes: 1
          modez: 92353
[mflament@uhura mflament]$ more wclipping_masterdark
===== statistics for iraf/median_dark.fits =====

      extname:  PRIMARY
```

```
minimum value: 96.500000
pixel coord: (506,88)
maximum value: 124.5
pixel coord: (11,1)
mean: 106.6750511
median: 106
sigma: 3.59697086
sum: 111710433.5
cnvrgd: YES
#good pixels: 1047203
#null pixels: 0
#clip pixels: 1373
mode: 105
modes: 1
modez: 92228
[mflament@uhura mflament]$ na
```

2 Number 2

2.1 Part a)

See attached.

2.2 Part b)

See attached.

2.3 Part c)

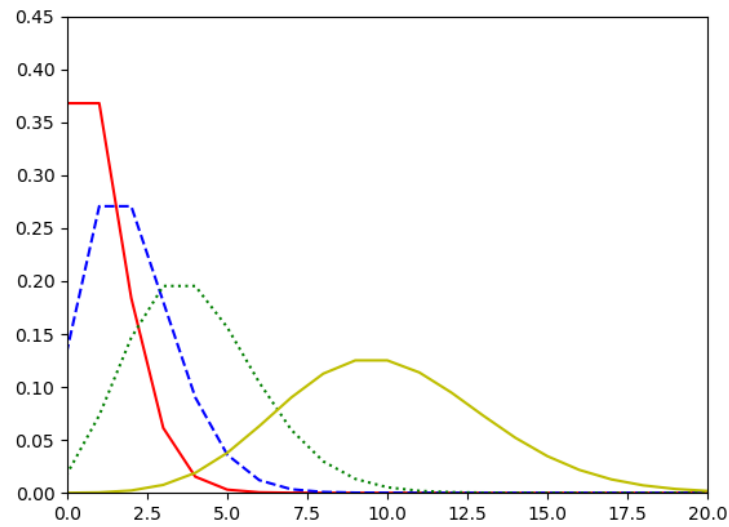


Figure 4: Poisson Distributions with mean of 1 (red), 2 (blue), 4 (green), 10 (yellow).

2.4 Part d)

For mean of 30, the standard deviation of a Poisson distribution is $\sqrt{30}$, so this was also chosen as the standard deviation for the Gaussian such that the widths of the two distributions would be similar.

3 Number 3

3.1 Part a)

See attached.

3.2 Part b)

See attached.

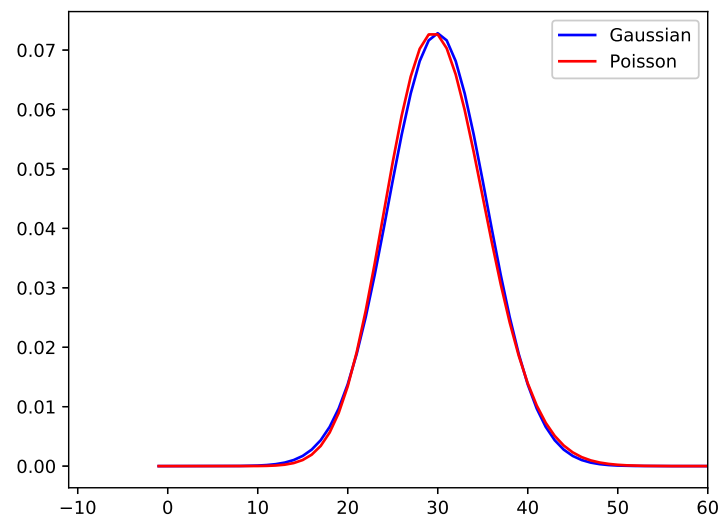


Figure 5: Poisson and Gaussian for mean of 30 and stddev of $\sqrt{30}$.

4 Number 4

See attached.