***AST HW2: Uncertainties in stellar brightness from digital images***
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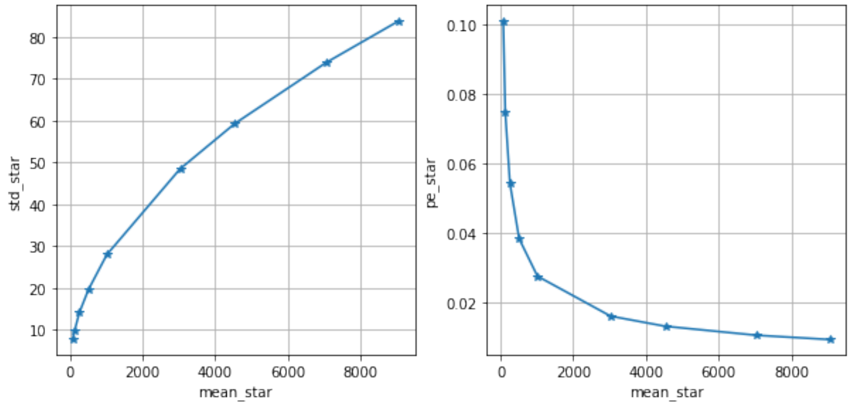
***Sep.29 2019***

1. The two plots have shown the following linear relationships:
   1. $\delta S = \sqrt{S}$
   2. $\%_{pe} = \frac{1}{\sqrt{S}}$

The stars' standard deviation increases with their signal in counts, the percent error decreases with the signal in counts, which means the measurements are getting more accurate if counting more.




2.

- $R \pm \delta R = \frac{S_A}{S_B} \pm |R| * \sqrt{(\frac{\delta A}{S_A})^2 + (\frac{\delta B}{S_B})^2}$
- The brightness ratio between star1 and star2 is $1.285 \pm 0.0180$. It can also be represented as percent error $= \delta R/R$, which is $1.285 \pm 1.398\,\%$ .
- The brightness ratio between star1 and star9 is $120.017 \pm 12.1565$. It can also be represented as percent error $= \delta R/R$, which is $120.017 \pm 10.129\,\%$
- From the algebraic formula, we can see that the factors that will affect $\delta R$ is $R, \delta A, S_A, \delta B, S_B$. We concludes from the images that the brighter stars are, the smaller $\delta Star/S_{star}$ ratio they have. Star2 is brighter than star9. Therefore, $\sqrt{(\frac{\delta A}{S_A})^2 + (\frac{\delta B}{S_B})^2}$ is larger for the ratio between Star1 and Star9. $|R|$ is simply larger when we compares the brightness between star1 and star9.

3.

- $S_{star} = S_{obs} - B_{tot} = 200 - 30 = 170$
- $\delta S_{obs} = \sqrt{\delta S_{obs}} = \sqrt{200} = 14.142$
  $\delta B_{tot} = \sqrt{\delta B_{tot}} = \sqrt{30} = 5.477$
- $\delta_{Star} = \sqrt{(\delta S_{obs})^2 + (\delta B_{tot})^2} = \sqrt{14.142^2 + 5.477^2} = 15.1655$
- The best estimate for $S_{star} \pm \delta S_{star} = 170 \pm 15.1655$