

# PHY517 / AST443: Observational Techniques

Fall 2017

## Homework 3

1. The Poisson distribution describes the probability to observe  $x$  events during a certain measurement interval, given a mean rate  $\mu$ :

$$P_{\text{P}}(x|\mu) = \frac{\mu^x}{x!} e^{-\mu}$$

Note that  $x$  has to be a positive integer.

- (a) Show that the mean of the Poisson distribution is  $\mu$ .
  - (b) Show that the variance of the Poisson distribution is  $\mu$ .
  - (c) Plot (on a single panel) the Poisson distribution for rates of  $\mu = 1, 2, 4, 10$ .
  - (d) For  $\mu = 30$ , plot the Poisson distribution, as well as a Gaussian distribution of mean  $\mu = 30$ . Motivate your choice of standard deviation when plotting the Gaussian.
2. Write a (python) script that takes as input two FITS images, and outputs the difference of the images (in FITS format).

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Hint: the following series identity is useful for Exercise (1):

$$\sum_{k=0}^{\infty} \frac{\lambda^k}{k!} e^{-\lambda} = e^{\lambda}$$