

Astronomy 337
Spring 2009
Homework 3: Statistics I
Due Tuesday, March 3

1. Gaussian FWHM

Starting with the functional form for a Gaussian (normal) distribution

$$dP_x = \frac{1}{\sigma_w \sqrt{2\pi}} \exp\left[-\frac{(x - m)^2}{2\sigma_w^2}\right] dx,$$

show that the full-width at half maximum (FWHM) is equivalent to 2.36σ , where σ is the width parameter of the distribution.

2. You have at your disposal an R -band image, "Rlynx2.fits", of the Lynx 2 field from the Leiden-Berkeley Deep Survey (LBDS) obtained by me and David Koo (UC Santa Cruz) at the Keck I telescope to study faint radio galaxies, which are scattered throughout the image.

Use IDL and *atv* to study the statistics of the image.

- (a) What is your best estimate of the value of the sky background brightness in ADU (= counts)? How would you justify your answer?
- (b) What is the RMS uncertainty of the background? Measure that value in at least two different ways, and compare them!
- (c) Are the background and RMS uncertainty values consistent with Poisson statistics? Assume 1 ADU corresponds to 1 photo-electron counted by the detector. Explain your answer quantitatively!
- (d) Locate a bright (but unsaturated) star image and a very faint star or galaxy image, just bright enough that you are confident it's a real object and not an artifact of the image. What is the signal-to-noise (S/N) ratio of the **peak pixel** of each?