Astrostatistics

Saturday, 28 January 2019

- Statistics Foundations
  - Ivezic Ch 4 “Classical Statistical Inference” & Ch 5 “Bayesian Statistical Inference”
  - F&B Ch 3 “Statistical Inference”
- Soon: Fitting Statistical Models to Astronomical Data
  - Hogg, Bovy & Lang. “Data analysis recipes: Fitting a model to data”. https://arxiv.org/abs/1008.4686

Fitting Models to Astro Data

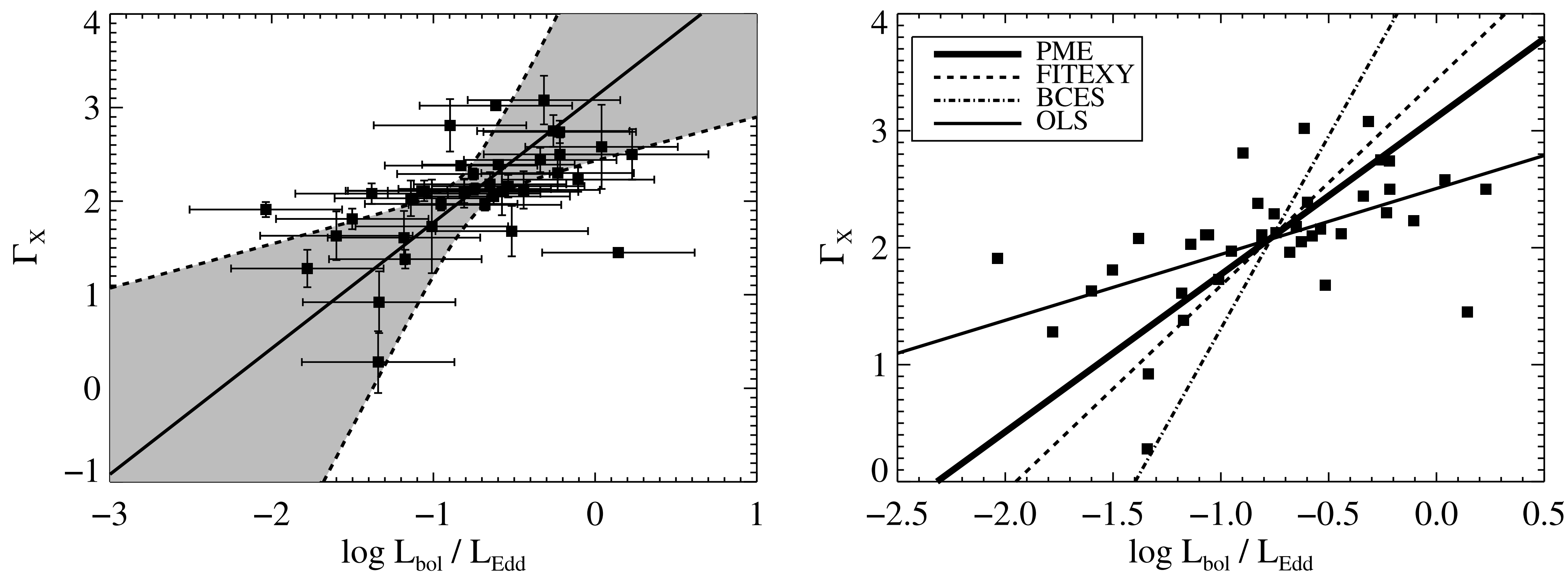


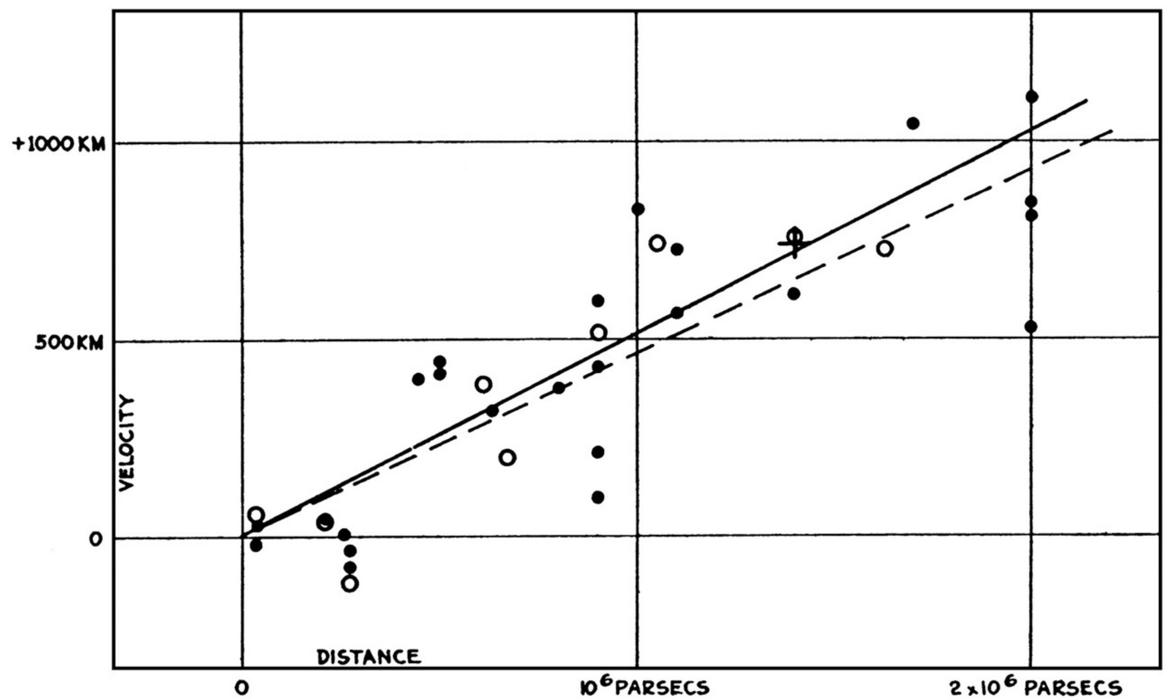
FIG. 10.—X-ray photon index Γ_X as a function of $\log L_{bol}/L_{Edd}$ for 39 $z \lesssim 0.8$ radio-quiet quasars. In both plots, the thick solid line shows the posterior median estimate (PME) of the regression line. In the left panel, the shaded region denotes the 95% ($2\,\sigma$) pointwise confidence intervals on the regression line. In the right panel, the thin solid line shows the OLS estimate, the dashed line shows the FITEXY estimate, and the dot-dashed line shows the BCES($Y|X$) estimate; the error bars have been omitted for clarity. A significant positive trend is implied by the data.

Modelling heteroskedastic, correlated measurement errors in both y and x, intrinsic scatter, nondetections, selection effects

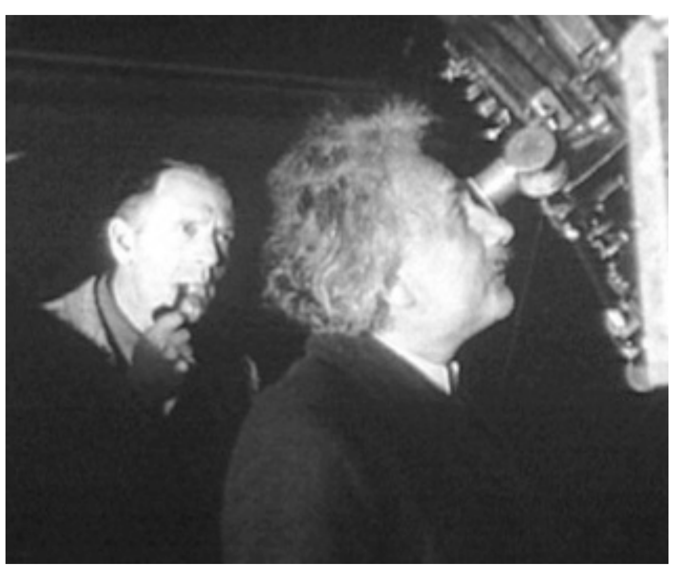
B. Kelly et al. 2007, "Some Aspects of Measurement Error in Linear Regression of Astronomical Data." The Astrophysical Journal, 665, 1489

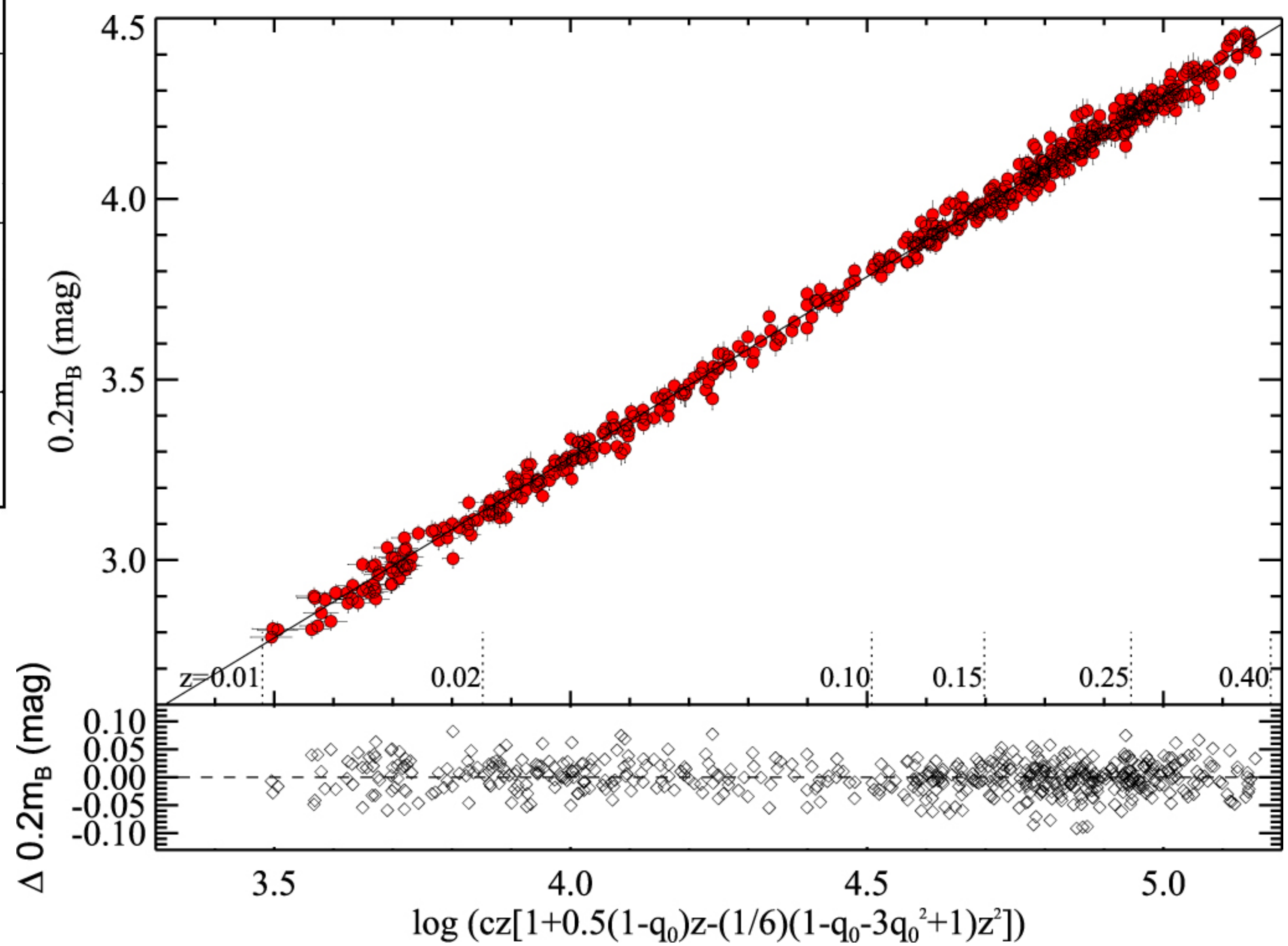
Hubble Constant

Distance = $H_0 \times$ velocity



Hubble (1929)

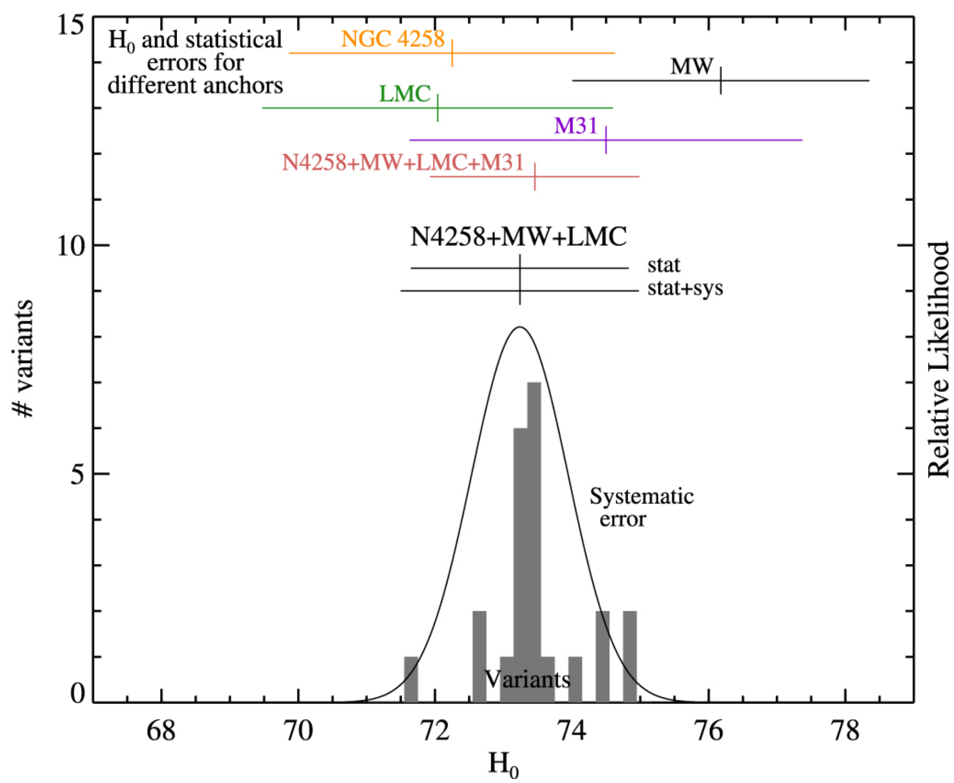


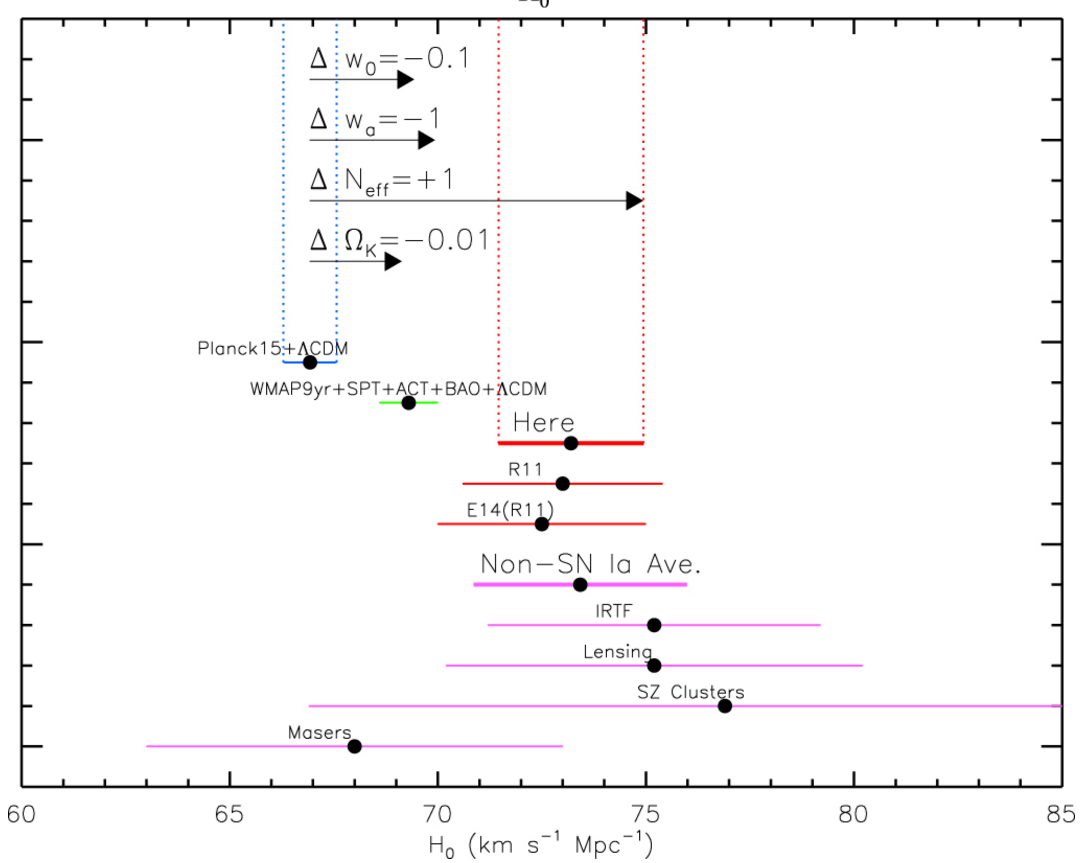


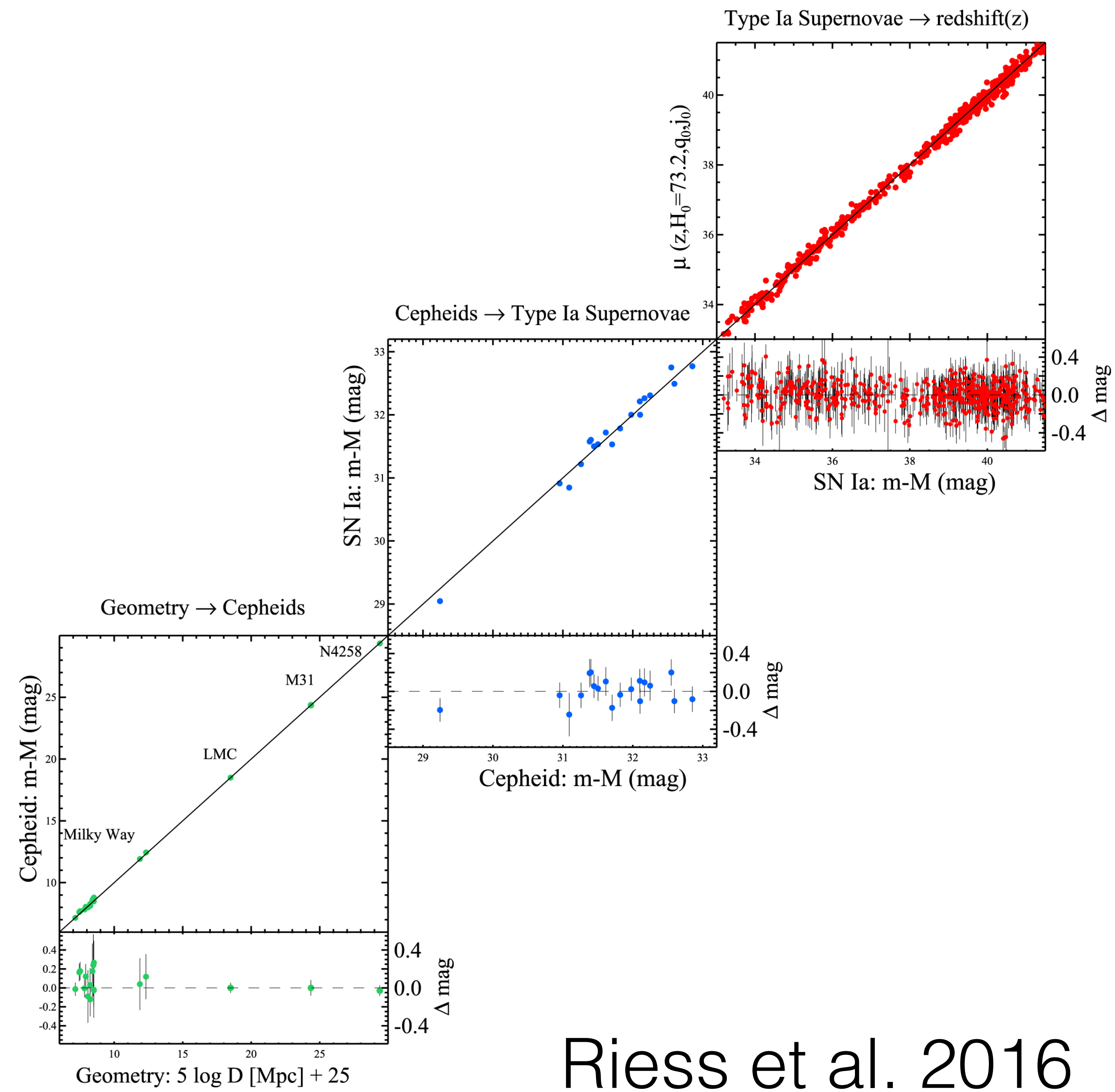
Riess et al. 2016

Hubble Constant

Distance = H_0 × velocity







Riess et al. 2016

Shortcomings of Propagation of Error

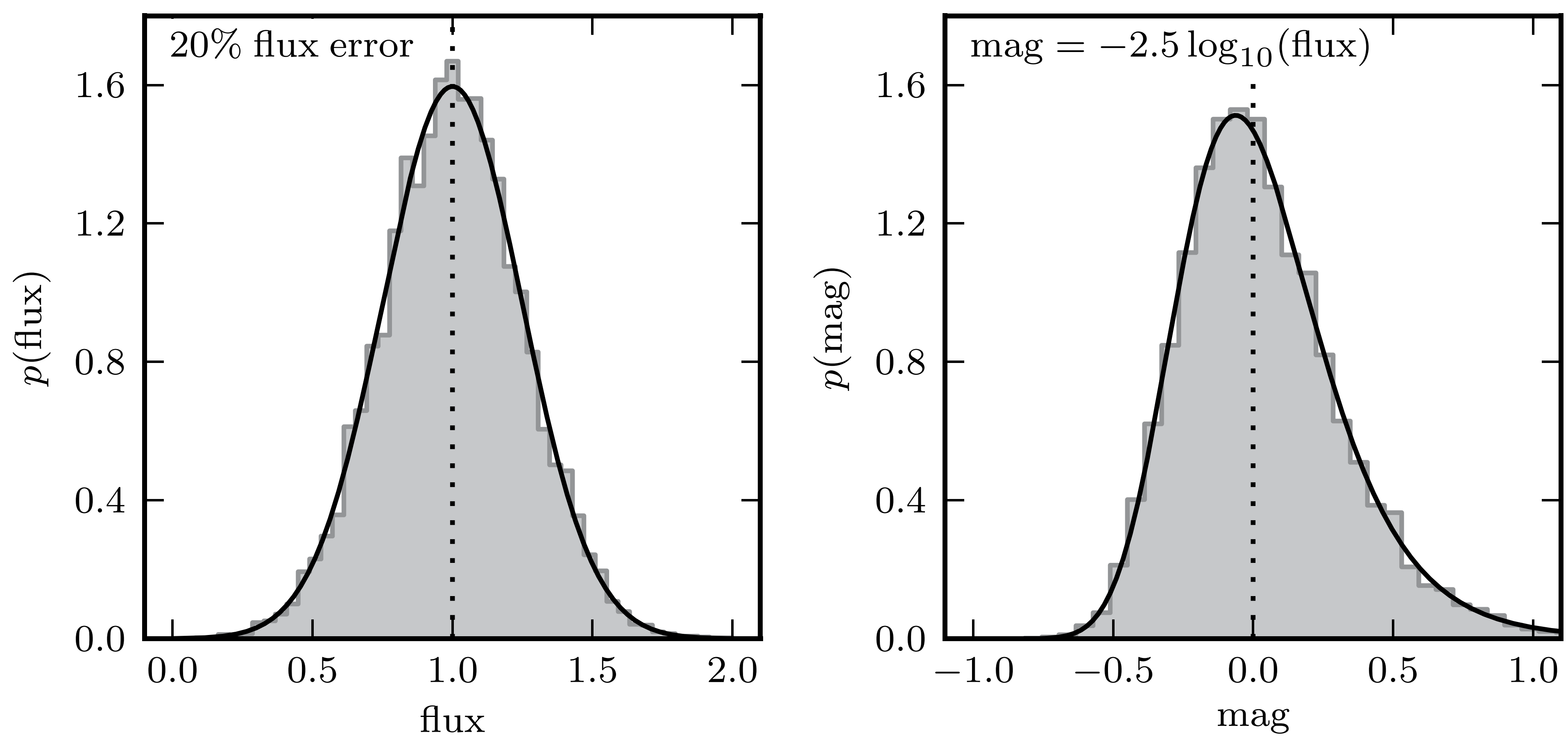
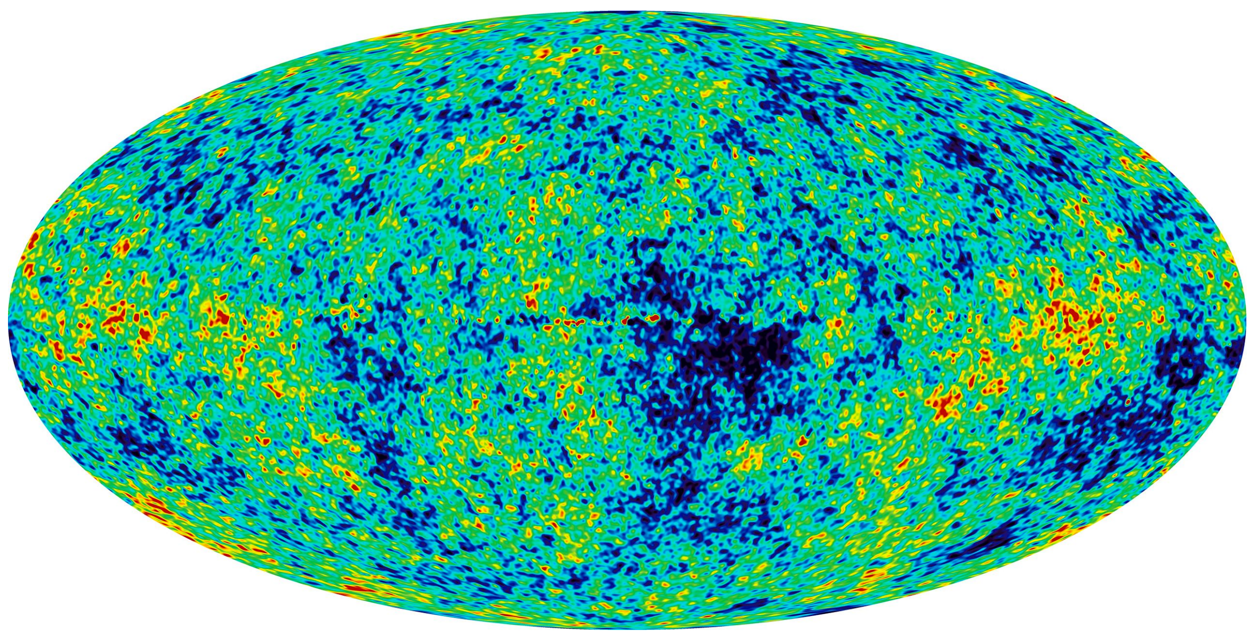
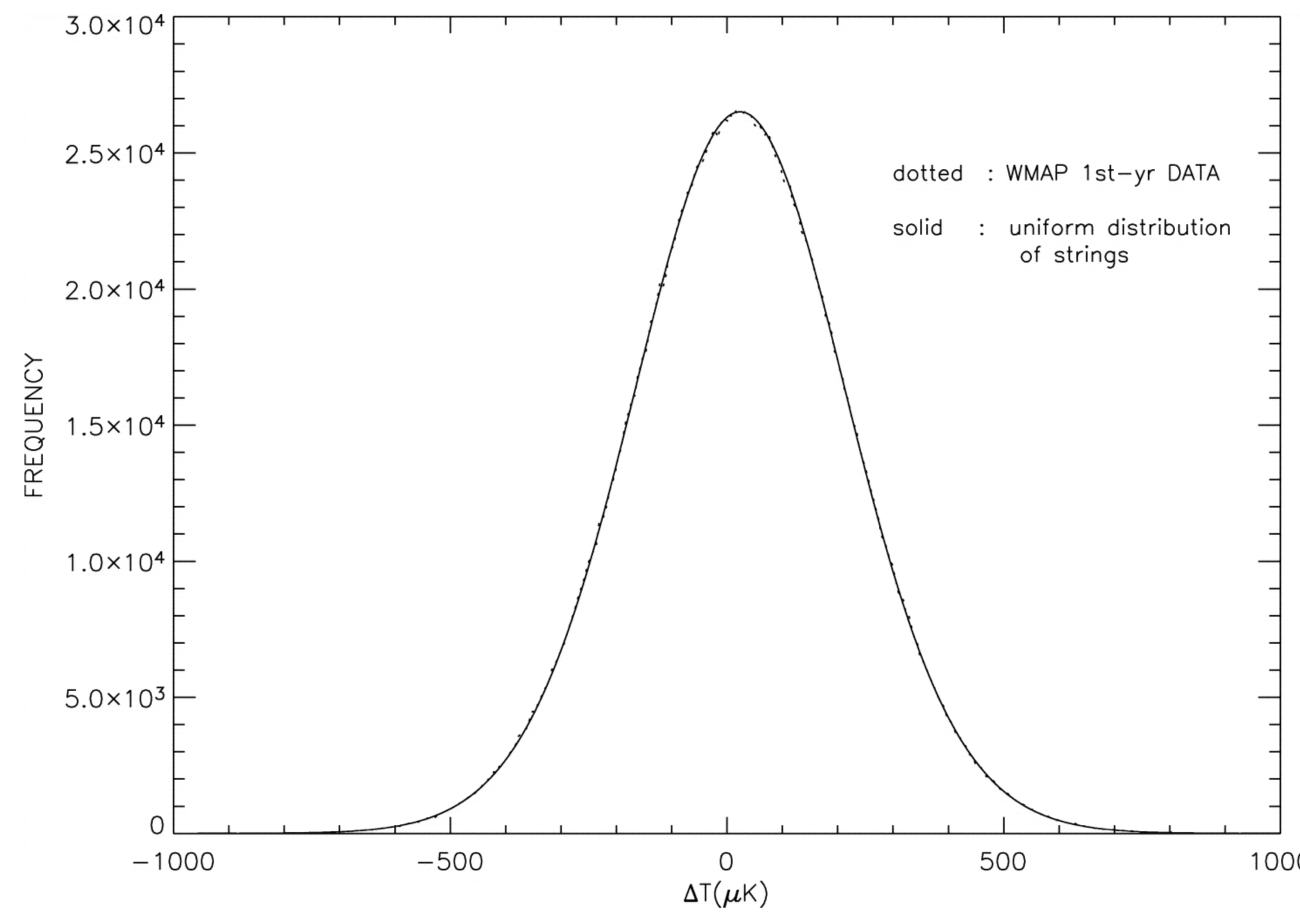


Figure 3.5. An example of Gaussian flux errors becoming non-Gaussian magnitude errors. The dotted line shows the location of the mean flux; note that this is not coincident with the peak of the magnitude distribution.

Cosmic Microwave Background



WMAP of the sky



Gaussian distribution of temperatures at each pixel