

ASTRO589

Hw4

Question

1. Let's estimate the luminosity function from the HETDEX mock data in the following directory:

http://personal.psu.edu/duj13/ASTRO589/data/Lz_mock_#.h5

where I stored the luminosity L , flux F , redshift z in the HETDEXmock group. The mock galaxies are for 1 sq. deg. footprint with the standard HETDEX filling factor of 1/4.5. Here's the list of fiducial cosmological parameters: $h = 0.6778$, $\Omega_m = 0.30821$, $\Omega_\Lambda = 0.69179$.

For simplicity, we use the fixed flux limit, $F_{\text{lim}} = 3 \times 10^{-17}$ erg/cm²/s with $\alpha = -3.5$ entering the completeness curve (called Fleming's function):

$$p(F) = \frac{1}{2} \left[1 - \frac{2.5\alpha \log_{10}(F/F_{\text{lim}})}{\sqrt{1 + (2.5\alpha \log_{10}(F/F_{\text{lim}}))^2}} \right] \quad (1)$$

- (a) Choose one of the files in the folder, and plot the mock galaxies in the (L, z) plane.
- (b) Using the $1/V_{\text{max}}$ method, estimate the luminosity function for all the mock realization that you choose.
- (c) Estimate the uncertainties of the measurement by using the bootstrap resampling (that is, shuffle indices allowing duplications). For the B bootstrap resamples (with index i), estimate the luminosity function using exactly same method, then estimate the variance from

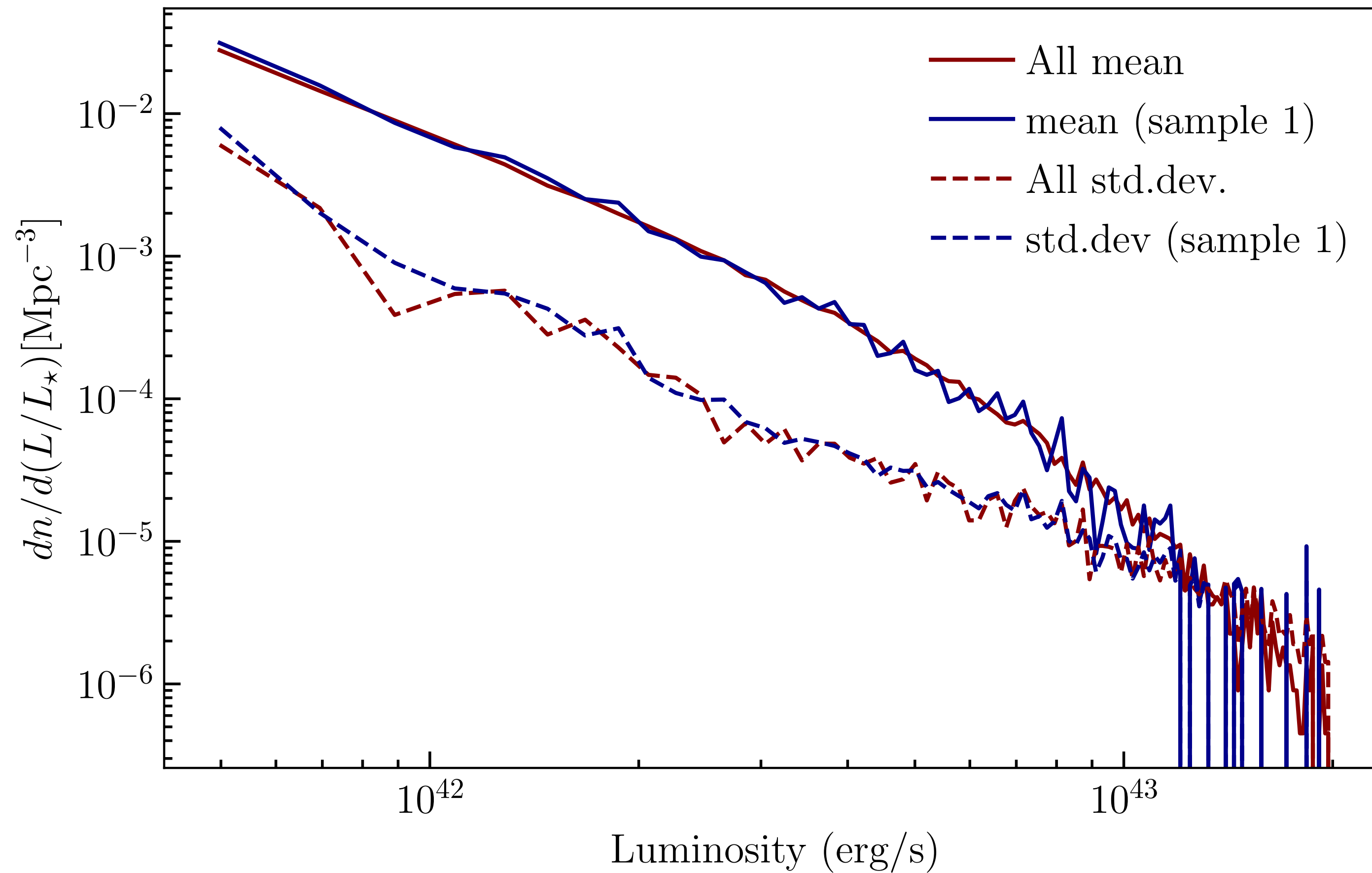
$$\sigma^2 = \frac{1}{B} \sum_{i=1}^B \left[\theta_i - \left(\frac{1}{B} \sum_{i=1}^B \theta_i \right) \right]^2. \quad (2)$$

- (d) Finally, fit the luminosity function with the Schechter function

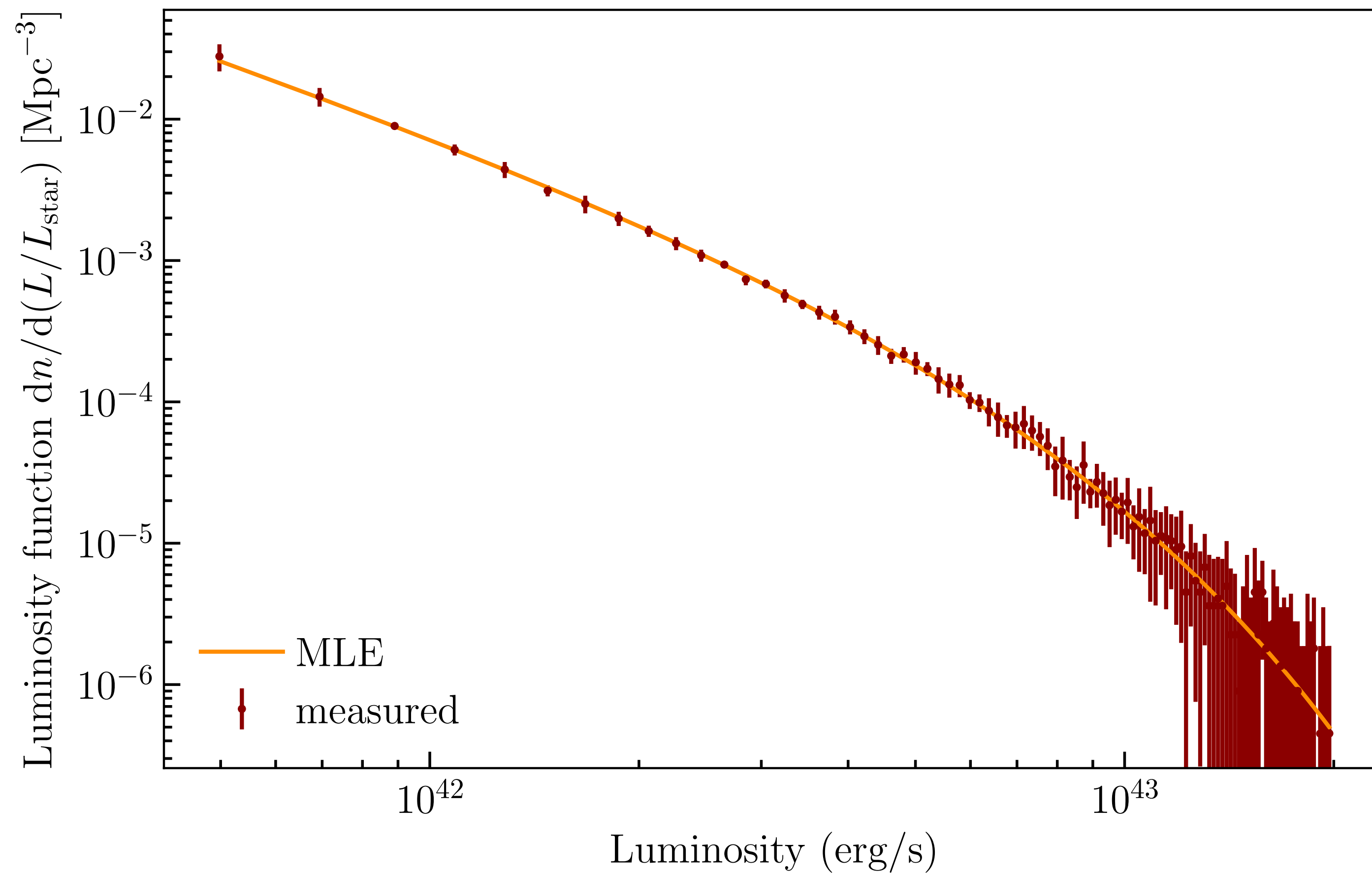
$$\frac{dn}{d(L/L_*)} = \phi_* \left(\frac{L}{L_*} \right)^\alpha \exp\left(-\frac{L}{L_*}\right) \quad (3)$$

parameters α , ϕ_* , L_* . Find their best-fitting values and marginalized $1 - \sigma$ (68 C.L.) intervals.

mean/var: Bootstrap and sample



Schechter function fitting



Marginalized 1d-pdf

