An alternative method: inferring the probability distribution of Teff taking in to account photometric/ astrometric/extinction uncertainties

The method adopted by Green et al. 2014, ApJ, 783, 114

Posterior probability distribution Likelihood Prior distribution

$$p(\Theta \mid \mathbf{m}) \propto p(\mathbf{m} \mid \Theta) p(\Theta)$$

Model parameters **Observed data (magnitudes and parallax)**

Model: $\Theta = \mu, E(B-V), \log(\mathrm{Age}), [\mathrm{Fe/H}], m_{\mathrm{star}}$

Data: $\mathbf{m} = (m_g, m_r, m_i, m_z, m_y, \pi)$

π : parallax $(1/\pi[\mathrm{mas}] = \mathrm{distance[kpc]})$

Likelihood function

$$p(\mathbf{m} \mid \Theta) = \mathcal{N}(\mathbf{m} \mid \mathbf{m}_{\rm mod}, \sigma)$$

$$\mathbf{m}_{\rm mod} = \mathbf{M}(\log(\mathrm{Age}), [\mathrm{Fe/H}], m_{\rm star}) + \mathbf{A}(E(B-V)) + \mu, \pi_{\rm mod}(\mu)$$

σ : observational errors in magnitudes and parallax

Prior distribution

Following Green et al. 2014

μ **Stellar distribution in the Galaxy**

$E(B-V)$ **flat prior, 0.0 to SFD 2D dust map value (Schlegel, Finkbeiner & Davis 1998)**

$\log(\mathrm{Age})$ **flat prior, 6.6-10.13**

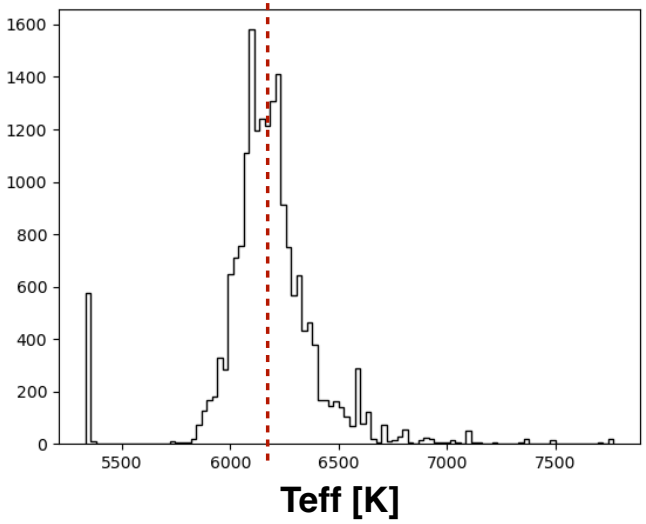
m_{star} **Kroupa Initial Mass function**

$[\mathrm{Fe/H}]$ **[Fe/H] distribution depending on the Galactic position (l, b, distance) suggested by Ivezic et al. 2008**

Test run

A star from SDSS/SEGUE

- Teff = 6230 K
- [Fe/H]=-0.2
- logg = 3.9
- μ = 10.8



100000 samples, using 50 CPU cores
➡ 76793.0 seconds