Observational Techniques in Astrophysics — Solution

Lecturer: Prof. K. Schawinski

Assistant: L. Sartori (lia.sartori@phys.ethz.ch)

23 September 2013

---

1 Conversion between Vega and AB magnitudes

1. Figure 1 shows the spectrum of Vega normalized to $m_{\rm AB} = 0$ at $\lambda = 5500$ Å, together with the *UBVRIJHKs* filter response curves.

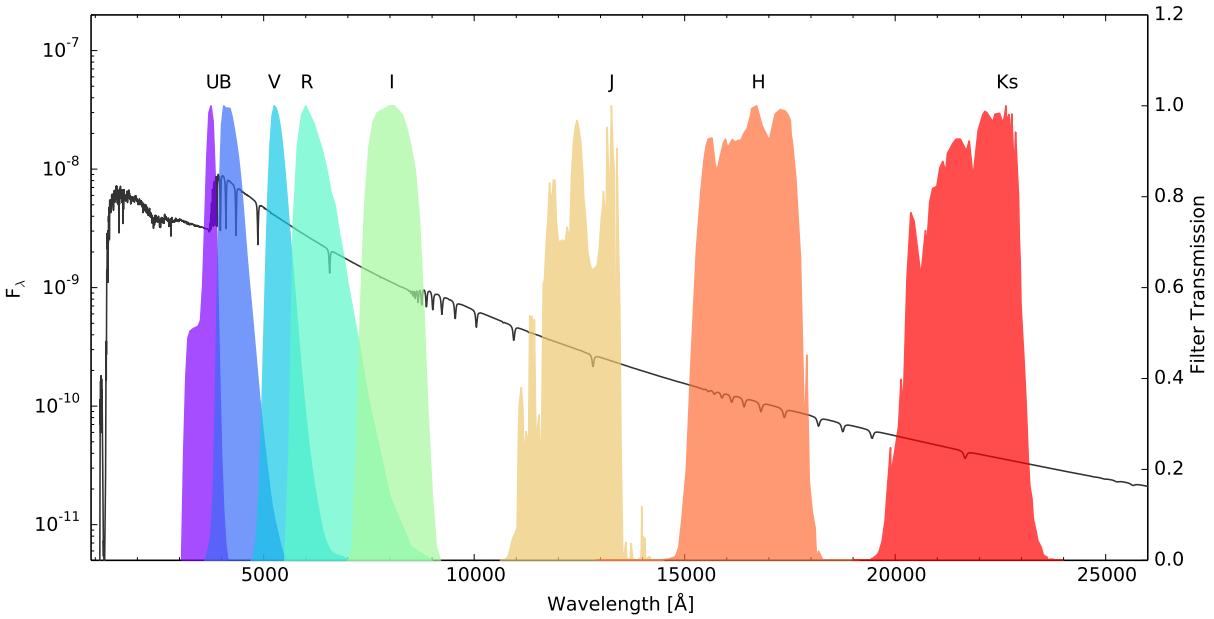

Figure 1: The solid black line shows the spectrum of Vega normalized to $m_{\rm AB} = 0$ at $\lambda = 5500$ Å. The filled areas correspond to the filter transmission curves.

2. –

3. The offsets between Vega magnitude and AB magnitude, defined as $\Delta m = m_{\rm AB} - m_{\rm Vega}$, are given in Table 1.

4. By normalizing the spectrum of Vega to this flux scale, the Vega magnitudes of Vega are always zero in all photometric bands (by definition). This means that the offsets found in 3. correspond to the AB magnitude of Vega in the given bands. However, it has turned out that Vega has a V-band magnitude of 0.026 (Tokunaga and Vacca 2005, PASP, 117, 421).

Table 1: Offsets between Vega and AB magnitude

Filter	$\Delta m = m_{\rm AB} - m_{\rm Vega}$
U	0.73
B	−0.12
V	0.00
R	0.20
I	0.45
J	0.91
H	1.39
Ks	1.86

2 Stellar mass function

1. The *GAMA* stellar mass function is shown in Figure 2 (black circles).

2. The best-fit double-Schechter function is shown with black solid line in Figure 2. Each Schechter component is also shown with red and blue solid lines, respectively.

3. The best-fit Schechter parameters are

   $(M^*, \phi_1^*, \alpha_1, \phi_2^*, \alpha_2) =$

   $(4.56 \times 10^{10}\,M_\odot, 3.95 \times 10^{-3}\,{\rm Mpc}^{-3}{\rm dex}^{-1}, -0.34, 7.995 \times 10^{-4}\,{\rm Mpc}^{-3}{\rm dex}^{-1}, -1.47)$.

   As a comparison, Baldry et al. (2012, MNRAS, 421, 621) derived the best-fit parameters as

   $(M^*, \phi_1^*, \alpha_1, \phi_2^*, \alpha_2) =$

   $(4.57 \times 10^{10}\,M_\odot, 3.96 \times 10^{-3}\,{\rm Mpc}^{-3}{\rm dex}^{-1}, -0.35, 7.9 \times 10^{-4}\,{\rm Mpc}^{-3}{\rm dex}^{-1}, -1.47)$.

4. The lower-mass component (blue line in Figure 2) represents blue, star forming galaxies. The higher-mass component (red line) correponds to red, quiescent galaxies.

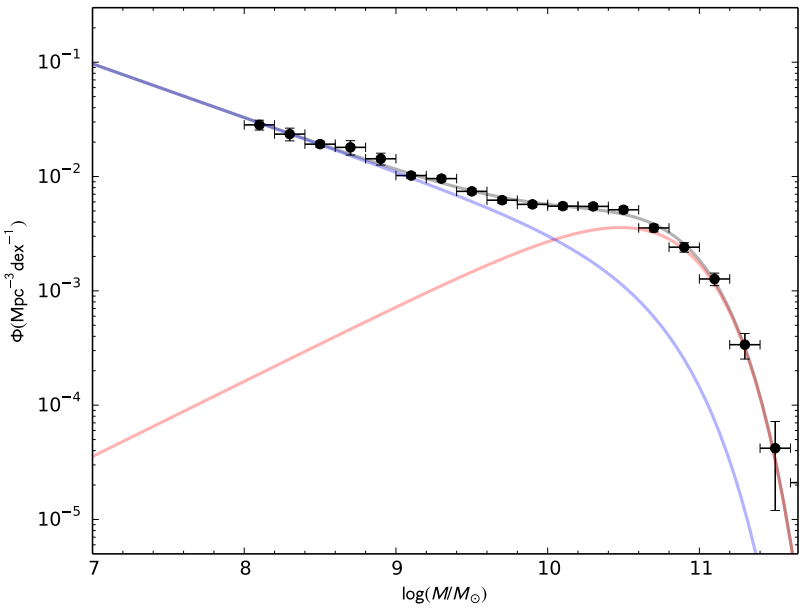

Figure 2: Stellar mass function from the *GAMA* survey (black circles; Baldry et al. 2012, MNRAS, 421, 621). The solid black line shows the best-fit double-Schechter function, while the red and blue solid lines correspond to each Schechter component.