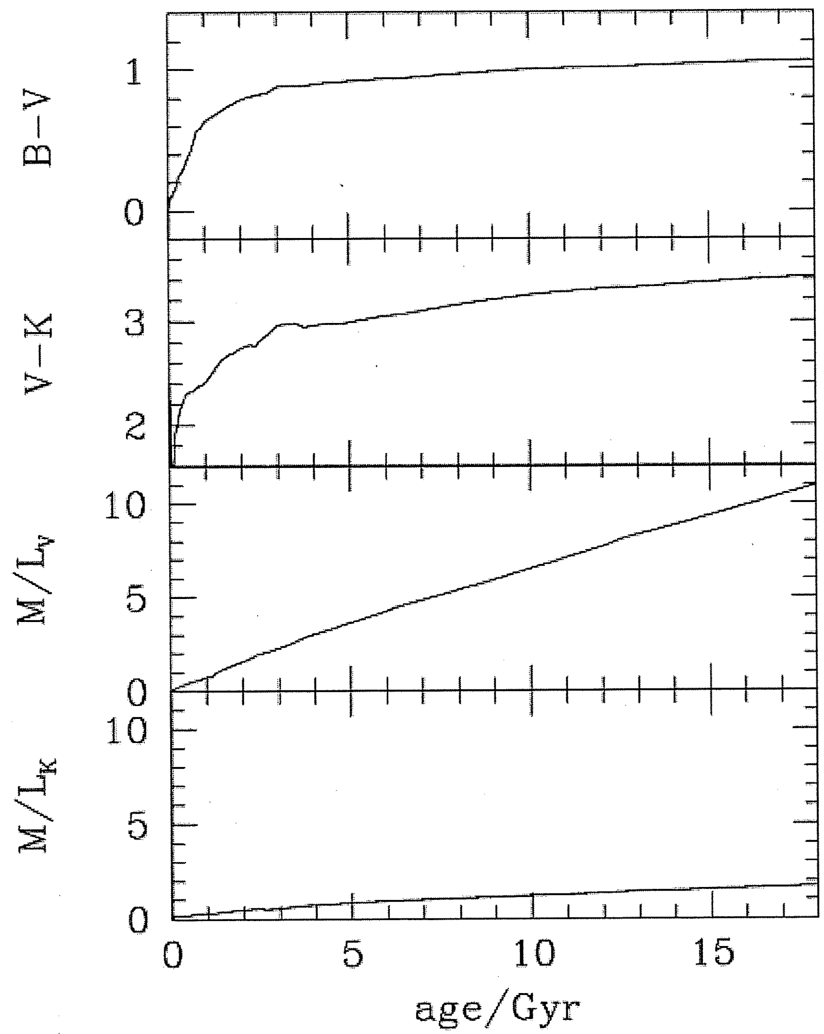
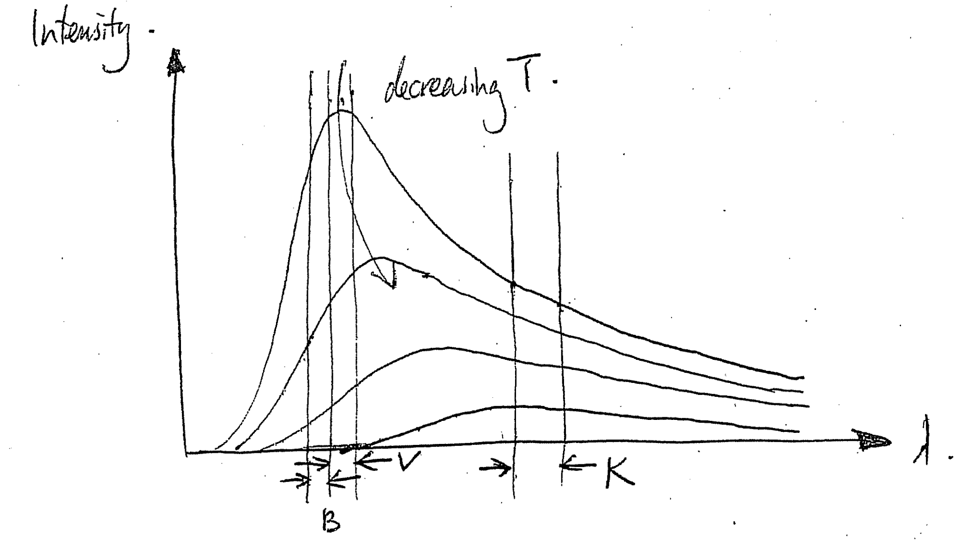
Age Dating A SSP

- If one just has colors then the H-R diagram is not so useful; the colors of a SSP can be calculated as a function of age (for a given metallicity) (See MBW pg 473)
- Notice the weak change in color vs age after ~3Gyrs, but the strong change in M/L_V and weak change in M/L_K

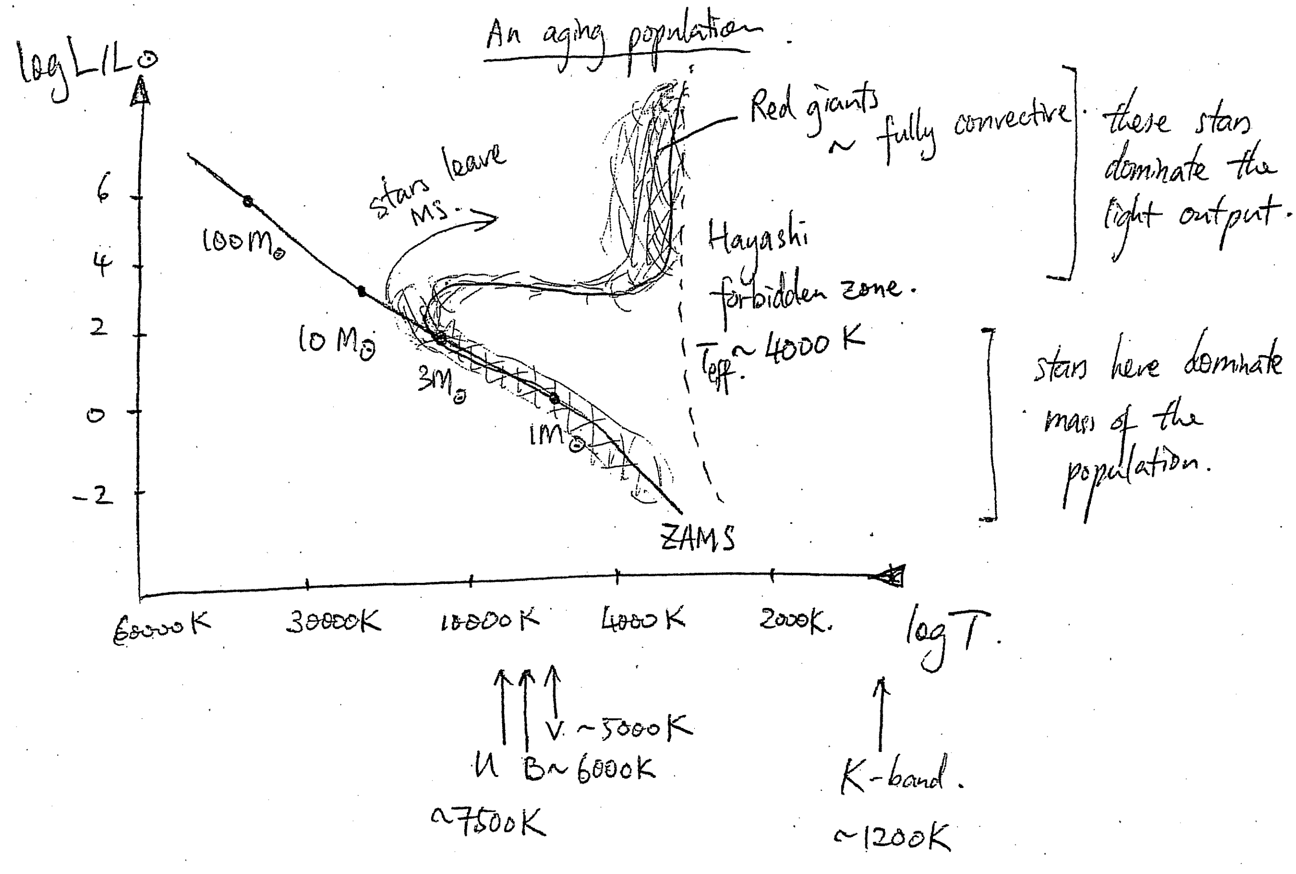
- *Quick quiz: why? please write down a 3 sentence explanation of why these plots look like they do.*





$\Delta mag \propto \log$ (ratio of fluxes)

Simple diagram to illustrate how flux ratios change with temperature. For stellar populations, spectra of the most luminous objects are the most significant.



- Colour-age diagrams. B−V, V−K show steep increase early on but plateau after ~ 3 Gyr. Increase in Δm means B band flux is becoming relatively more dim than V band (similarly for V−K). B−V is due to O, B stars burning out, since they are the main contributors to B band flux. The 'plateau' is slowly increasing as stars move off the MS and the population reddens. (Slow because by this point the significant contributors to luminosity peak at longer wavelength than both bands; they are collecting flux from the shorter λ tail, and for spectra that peak at longer λ than the bands there is always more flux from V which is closer to the peak.)
- V−K goes up quickly at first, then becomes steadily increasing. This one is more subtle (I think).

Wien's displacement law $\lambda_{max} \approx \frac{2.7\times10^{-3}\ \mathrm{mK}}{T_{eff}}$ approximates peak of stellar spectra. K-band is centred on 2.2 μm ⇒ T ~ 1200 K. A lightweight brown dwarf peaks in K-band. Most of the luminosity here comes from the tail of giants on the Hayashi track, T ~ 4000 K. The steep initial rise is due to the major contributors to V, the massive stars, evolving quickly early on and becoming major contributors to K instead... (Kind of a double-whammy?)

- V−K goes up faster as the main sources (MS) evolve to contribute to the K band
- V−K has larger values. I think it is because of the lack of luminous ~~objects~~ stars in V ~~back~~ band long-lived enough, to increase the light output in this band.
- M is mostly contained in low mass stars. It is almost unchanged as the population evolves.
- L_V decreases steadily as stars evolve and the MS turn-off moves to the red. Not a lot of contribution to this from massive MS stars or RGs.
- L_K would ↑ when a star goes onto the RG stage, but lose this source when the star evolves further. Overall effect is to lose a minor contributor to K band flux, on timescales greater than the post-MS life of the star. On Gyr-timescale L_K ↓ slowly. This reflects the general trend for MS stars that mass-to-light ratios increase with decreasing mass.