普通天文學　二〇一四年春 期中考

2014.04.17 Thursday 10:10～11:50

Useful constants and quantities

Solar mass: 2×10^{30} kg; AU: 1.5×10^{11} m; Gravitational constant G: 6.7×10^{-11} N m²/kg²;

parsec: 3×10^{16} m; Planck constant h: 6.6×10^{-34} J s; speed of light c: 3×10^{8} m/s

一、解釋下列名詞（**3% each**）

  (1) brown dwarf;　(2) limb darkening;　(3) eclipsing binary;　(4) Maunder diagram;
  (5) solar constant; (6) Cepheid variable; (7) asymptotic giant branch;
  (8) interstellar reddening;　(9) Population I star; (10) H II region

二、問答題：

1.　(a) The Sun has an apparent magnitude of -26.7.　What is its absolute magnitude?
　　(b) Betelgeuse (Alpha Orionis) is 60,000 times more luminous than the Sun and has a surface temperature of 3500 K.　The Sun's radius is about 7×10^{8} m, what is the radius of Betelgeuse in kilometer? (10%)

2.　(a) Draw a Hertzsprung-Russell diagram.　Clearly label and explain the physical quantity associated with each axis.　(b) Draw the main sequence and mark where the Sun is in the diagram. (c) What are the spectral type and the luminosity class of the Sun? (d) The Sun is estimated to be 5 billion years old.　How is this known?　(e) On the HR diagram, draw the evolutionary track of the Sun after the main sequence. In a separate text, describe how the structure of the Sun changes at each stage of the evolution.　(25%)

3.　(a) What is the energy source of the Sun as a main-sequence star?　State one piece of observational evidence to support your answer.　(b) Stars like our Sun, after their main-sequence phase in evolution, will engage in an explosive event in their cores, called the "*helium flash*". Explain what a helium flash is, and why such an event occurs only in low-mass stars, but not in massive stars. (20%)