

普通天文學 二〇〇八年春 期中考

2008.04.14 下午 3 : 00 ~ 4 : 50

一、解釋下列名詞（每小題 4 分）

- (1) Solar constant (2) Roche lobe (3) spectral classification (4) spectroscopic parallax
(5) eclipsing binary (6) dense molecular cloud core (7) emission nebula (8) H II region
(9) brown dwarf (10) Chandrasekhar limit

二、問答題：每題 10 分

- (a) What is the minimal aperture size of a telescope in order to see a 10th mag star through that telescope with a naked eye? (b) This 10-mag star turns out to be a binary with a brightness ratio of 4. Derive the apparent magnitude for each star in the binary system. (c) If this binary system is seen to have an orbital period of 2 years, what do we know about the stellar masses?
- (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 km, what is the radius of Betelgeuse?
- Draw a Hertzsprung-Russell diagram. Clearly label and explain the physical quantity associated with each axis. Draw the main sequence and mark where the Sun is in the diagram.
- You are asked to write an essay about the evolution of our Sun, from its birth as a protostar, to a T Tauri star. (a) What energy source does the protosun have in order to shine? (b) The Sun then became a main-sequence star. How about the energy source in this stage? How long does the Sun remain as a main-sequence star? (c) Describe the subsequent evolution after the main sequence, in as much detail as possible, the structure and energy source in each stage. (d) What kind of an object will the Sun become eventually? It is your decision to write it in Chinese or in English.
- The expanding angular speed of the Crab Nebula, a supernova remnant in the constellation of Taurus, is about 0.15 arcsec/year. Spectral analysis based on the Doppler effect indicates a line-of-sight speed of 1500 km/s. (a) Assuming a spherical expansion, estimate the distance to the Nebula. (b) Given the angular extent of $6'$ times $4'$ for the Nebula, estimate when the supernova explosion was recorded.
- The Schwarzschild radius defines the size of a black hole. Derive the Schwarzschild radius in terms of the mass of an object. How large is the size of a supermassive black hole of a billion solar masses?