

# Astronomical Observations (Fall 2003)

## Midterm Exam

**4 November 2003, Tuesday 18:00~20:00**

Each problem carries equally 20 points.

1. One of the effects of the Earth's atmosphere to astronomical observations is limited wavelength range. Compared to other wavelength bands, there are relatively transparent 'windows' in optical and radio parts of the electromagnetic spectrum. The optical window is roughly from 300 nm to about 1.4 microns. (1) Describe what limit the shortest and longest wavelength cutoffs of the optical window. (2) Beyond the optical window, the atmosphere is largely opaque to ultraviolet radiation, yet becomes progressively transparent toward hard X-ray and gamma-ray radiation. Why? (3) What is 'atmospheric seeing'? How does it affect astronomical observations on the ground? (4) What factors need to be considered in selection of a suitable site for an observatory? State your reasoning.
2. Compare the pluses and minuses, optically and mechanically, of a refracting telescope (using lenses) versus a reflecting telescope (using mirrors). Why are modern, large optical telescopes all reflectors?
3. Many new, large optical telescopes adopt the design of alt-azimuth mount. Compare the pluses and minuses of an alt-azimuth telescope mount versus an equatorial mount.
4. Jupiter is at an average of 5 AU away from the Sun. (1) Seen from Alpha Centauri, the nearest stellar system from us, at a distance of 4.3 light years (or 1.3 pc), what is the maximum angle (in seconds of arc) subtended by Jupiter and the Sun? (2) If there is also a Jupiter-like planet around Alpha Centauri, and we want to devise an optical telescope on the surface of the Moon to image the system. What is the minimal required diameter of the primary mirror of the lunar telescope to resolve the star-planet system? (3) The star Alpha Centauri is a 0<sup>th</sup> magnitude star. Assuming the planet around Alpha Centauri is intrinsically some  $10^8$  times fainter than the parent star. What is the apparent magnitude of that planet?
5. Briefly explain the following terms (1) vernal equinox, (2) meridian, (3) Universal Time, (4) Right Ascension, (5) chromatic aberration.