

ASTRONOMY 325H – PRACTICAL ASTRONOMY
2002-2003

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AST 325H is a laboratory course intended mainly for students following an Astronomy program.

The regular class meetings for AST 325H are held on Tuesday mornings from 10:00 until noon. During the first few weeks, class time will be spent on instruction in the use of the telescopes and equipment. However, some of this instruction must be done when it is dark. For this reason, we require that the students attend evening instruction sessions, as well. Instruction sessions for the Department of Astronomy (DA) 16-inch reflector will be held on Monday and Tuesday evenings and will start September 23rd, subject to the telescope being ready. Students will be required to attend these evening sessions each week until they know how to operate the telescope and equipment. Attendance will be taken.

There will be a class tour of the David Dunlap Observatory later in September or early October, as well as a visit to the Scarborough College Observatory to learn to use the 12-inch telescope. The class will also see the Student Radio Telescope.

Over the past year, the 16-inch and 12-inch telescopes have been upgraded for Internet operation, and are now being “commissioned”. There is some delay in finishing the Scarborough 12-inch upgrade due to problems with the declination bearings. Initially, we shall use the 16-inch locally, then remotely (e.g. from home computers), and later remotely with scripted (or robotic) operation. The class will be involved in this ramping up to full use, and much of the early use will involve tests and calibrations (the astronomy will be particularly practical this year). The 12-inch will be used remotely and in scripted mode.

An improved CCD will be installed on the 16-inch spectrograph around Christmas, and then the 16-inch will be capable of imaging as well as spectroscopy. The 12-inch has a particularly good CCD camera for imaging a 19 arc minute square field.

We can expect a paper to emerge from this work, in which participating class members will be co-authors.

COURSE OUTLINE

1. Instruction in
 - a) use of UNIX/Linux computers and the Internet
 - b) use of the 16-inch telescope at DAA and 12-inch at Scarborough,
 - c) right ascension, declination, hour angle, sidereal time, altitude, azimuth, zenith distance,
 - d) the use of telescope equipment: direct imaging camera and spectrograph with CCD detectors.
2. Review of magnitudes, colour indices, flux, intensity, distance modulus, etc.
3. Detectors across the electromagnetic spectrum, with emphasis on CCDs.
4. Reduction of astronomical data (photometric, spectroscopic).
5. Telescopes
 - a) types - space-borne, ground based optical and radio telescopes
 - b) geometrical and physical optics applied to telescopes
 - c)
6. Positional Astronomy
 - a) Co-ordinate Systems
 - i) celestial (ecliptic) longitude and latitude
 - ii) galactic longitude and latitude
 - b) Applications of Spherical Astronomy
 - i) transformation from one co-ordinate system to another
 - ii) effects of the earth's atmosphere: airmass and refraction
 - iii) precession, nutation and aberration
 - iv) conversion of geocentric radial velocities to heliocentric radial velocities
 - v) heliocentric time correction
 - vi) parallaxes, proper motions, measurements from space.
7. Time and the Calendar
 - a) Universal time, zone time, local mean time, apparent solar time.
 - b) Greenwich sidereal time, local sidereal time
 - c) International Atomic time, Terrestrial time and computers.
 - d) Global Positioning System

EVALUATION

1. : Assignments in data reduction **40%**

Fall Term

- 1) Astronomy, the Internet and the WEB
- 2) Introduction to IRAF and data handling

Spring term

- 3) CCD Imaging (with own data)
- 4) Spectroscopy (with own data) - reductions & analysis.

2. : A series of short open-book tests **40%**

October 22, 2002 (10%)

December 3, 2002 (10%)

February 4, 2003 (10%)

March 18, 2003 (10%)

3. : Observational report **20%**

USEFUL REFERENCES

An Introduction to Astronomical Photometry Using CCDs by W. Romanishin (University of Oklahoma). 2002. See my website or download from:

<http://observatory.ou.edu>

Observer's Handbook 2000 (Royal Astronomical Society of Canada).

Observational Astronomy by D. S. Birney (Cambridge)

Astrophysical Techniques by C. R. Kitchin (Hilger)(eds. 1-3)

Astronomical CCD Observing and Reduction Techniques, ed. S. B. Howell (ASP)

The New Cosmos (5th Ed.), by Unsold, A. and Baschek, B. 2001 (Springer-Verlag)
[Now the AST221/222 textbook]

Electronic and Computer-Aided Astronomy, by McLean, I.S. (Ellis Horwood).

Observational Astrophysics, by Smith, R.C. (Cambridge UP).

The Departmental Computer Manual is available at:

<http://www.astro.utoronto.ca/~stefan/manual/>

IRAF materials can be browsed at: <http://iraf.noao.edu>

HANDOUTS

A series of handouts will be given, on IRAF, using the Web for astronomy, using the automated telescopes, CCDs, CCDs and imaging, CCDs and spectroscopy, spectral analysis etc.