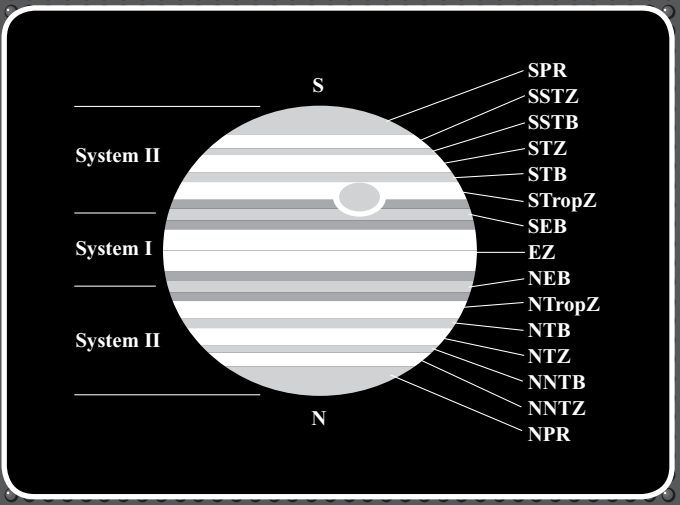
PRACTICAL OBSERVING

Observing The Planet Jupiter

REQUIREMENTS - You will need a telescope for this observation programme. A 75mm refractor or 150mm reflector are the minimum apertures with 2-300mm recommended. As with all planetary work a long focal length is preferable.



APPARITIONS - Jupiter's apparent diameter is always large compared to the other planets and varies in size from 30" at conjunction to 44-50" at opposition.

It has an orbital period of 12 years and will move through one zodiacal constellation per year. With a mean synodic period of 400 days (13 months) each successive year will see Jupiter's opposition move on one month.

Perihelic oppositions occur every 12 years giving a maximum apparent magnitude of -2.9. The next such events occur in 2010 and 2022.

The only time Jupiter cannot be observed is at conjunction when it passes behind the Sun (rendering it invisible for 1 - 2 months)

JOVIAN FEATURES - Almost everything visible on Jupiter is weather. Small instruments will reveal the principal bands, larger instruments will show more structure. The axis is at 3° as seen from Earth so the planet presents a side-on appearance, hiding much of the polar detail. The dark bands are Belts and can vary in colour and intensity. Their main constituents are ammonium hydrosulphide and oxides of sulphur. From the equator outwards we have the Equatorial Belts (with subdivisions) the Temperate Belts, the upper Temperate Belts and the Polar Regions. The white areas are Zones and are typically high altitude ammonia ice clouds. They divide into Equatorial, Tropical, Temperate and Upper Temperate. The latitudes of these remain fairly constant.

The most conspicuous feature is the Great Red Spot in the southern hemisphere which has been observed continuously for over 170 years, although its appearance changes with time. In addition there are many other transient spots and ovals, both dark and light that are worth monitoring in order for astrophysicists to understand Jovian atmospheric dynamics better.

JOVIAN SATELLITES - The four galilean satellites are visible in binoculars, other members of Jupiter's extensive family need large instruments to pick out. Transits, shadow transits, eclipses and occultations are interesting events to monitor.

RECORDING OBSERVATIONS - Most people like to observe and make notes, but developing drawing skills at the telescope is a worthwhile pursuit. Good drawings are welcomed as illustrations of the general appearance of the planet, and may occasionally be useful as records of special events e.g. the momentous impact of comet Shoemaker Levy 9 in 1994. The standard size for a disk drawing is 64 by 60 mm and blanks can easily be prepared in a DTP/drawing program.

A more advanced option is to develop one's style of drawing (or even colour painting) so as to combine observational accuracy with artistic quality. Another option is to make strip-maps (cylindrical projection maps) of part or all of the planet, one or more times during an apparition. This gives a valuable overview of the pattern of belts and spots around the planet.

Since the belts and zones remain in the same positions, the blanks may have faint guidelines printed to begin with. As with all drawings, spend some time at the eyepiece, using low and high magnifications until you have built up a good impression of the details. Unlike other planetary observations, the rapid rotation of Jupiter (under 10 hours) will cause appreciable motion of cloud features in ten minutes. Make sure you outline these rapidly and note down the time of the outline, rather than the finished drawing. You may shade and colour the drawing more at leisure after this outline has been completed.

Estimates of the intensity (darkness) of belts and zones can be made numerically on a scale from 0 (brightest) to 10 (black sky). They are inevitably subjective so are only worthwhile if done systematically and repeatedly within the context of a more detailed observational programme. Observers who make colour or intensity estimates should average them for the whole apparition.

PHENOMENA - The Great Red Spot can vary in colour from a deep brick red to virtually invisible against the background South Tropical Zone. It lies within a great bay in the South Equatorial Belt known as the Red Spot Hollow. It drifts slowly and irregularly in longitude and rotates anticlockwise every 6 - 12 days.

The South Tropical Disturbance is a grey barrier across the STropZ lasting for months or years and drifting slowly in latitude. There have been six short lived examples since 1939.

The most spectacular phenomenon seen on Jupiter is the disappearnce of the SEB (coincident with a deepening of the GRS colour) followed by its revival. A thin band develops, splitting into dark offshoots which eventually broaden to give the fully re-constituted belt (the GRS fading at the same time).

TRANSIT MEASUREMENTS - Useful longitude measurements of spots can be made by timing their 'transits'. This does not require any special equipment: one just estimates the time at which the spot crosses the centre-line of the disc (the central meridian). The observer should give the transit time to the nearest minute (which corresponds to 0.6° of rotation in longitude), together with a description of the feature observed. It is then necessary to calculate the Jovian longitude by refering to tables in the BAA Handbook or on the Web at http://www.arksky.org/JupCMCalc.html. Due to the differential rotation of Jupiter visual observers need to calculate timings for either System I features (rotation period 9h 50m 30s) or System II (rotation period 9h 55m 41s). There is a third system (System III) used by radio astronomers based on rotation of the planet's magnetic field. Any observer who sees an unexpected, possibly novel feature on the planet is urged to make a transit timing.

An advanced observer might wish to make transits systematically through an apparition, accompanying them with sketches. If transits are accurate and numerous enough (so that the observer's personal equation can be established), the observer could plot his/her own charts to follow spots on their different currents over several months, and these data could be used as a supplement to image-based analysis.

SATELLITE OBSERVATIONS - The transits, shadow transits, eclipses, and occultations of the four galilean satellites (Io, Europa, Ganymede and Callisto) are among the most striking phenomena that a beginner can observe. Although observations are not likely to have any scientific significance, observers may like to make accurate drawings of these phenomena, especially when several are occurring at once. Every six years, the satellites occult and eclipse one another, and it is interesting to plot visual light-curves of the mutual eclipses.

Identification of the satellites is made using ephemerides or plots found in the BAA handbook, Astronomy Now magazine, planetarium programs (e.g Skymap Pro) and http://ringside.arc.nasa.gov/www/tools/tracker_jup.html

PHOTOGRAPHY - Due to its large apparent diameter and family of satellites, Jupiter is a rewarding photographic target for fast fine grain films. To photograph the moons, a piggybacked 400mm lens will suffice and an exposure time of between 10 and 50 minutes (the planetary disc will be overexposed though). On very steady nights, belt and zone photography is possible using eyepiece projection. The same technique will also record shadow transits and eclipses. Colour film, although generally less fine grained than b&w for any given speed will allow more objective colorimetry comparisons, although atmospheric effects can often give wide variations in observed colour.

CCD cameras have become the tool of choice for imaging over the last few years, especially when used with long focal length catadioptric telescopes. Their sensitivity and correspondingly shorter exposure times means sharper detail can be recorded

AUXILIARY DATA - The following details should be added to any drawing or photograph:

- Date (written year, month, day)
- Time (UT) when outlines were completed
- Longitude of central meridian (CM) at this time
- Aperture and magnification of the telescope, together with any details of accessories
- Seeing conditions (Antoniadi)
- Location of observer
- Name of observer