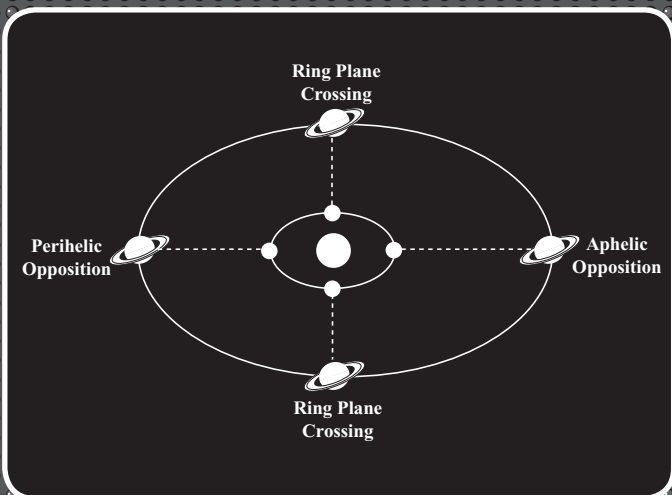




REQUIREMENTS - You will need a telescope for this observation programme. A 100mm refractor or 150mm reflector are the minimum apertures with 2-300mm recommended. As with all planetary work a long focal length is preferable.



APPARITIONS - Saturn's apparent diameter is half that of Jupiter being 17.5" x 19.5" (it is the most oblate body in the solar system) with little variation throughout its orbit. The ring system, however, is some 40" across, giving access to fairly small instruments. It has an orbital period of 29.5 years, a synodic period of 378 days and will come to opposition about a fortnight later each year. The mean brightness at opposition is 0.7^m but can reach -0.2^m depending on the aspect of the rings. The angle of inclination varies from edge on (0°) to ±29°. This is a combination of the axial tilt of Saturn (26.5°) and the inclination of the orbit (2.5°). Ring plane crossings are the best time to look for faint satellites and planetary detail. These occur at intervals of 13.75 and 15.75 years. Ring features are best viewed when they are fully open.

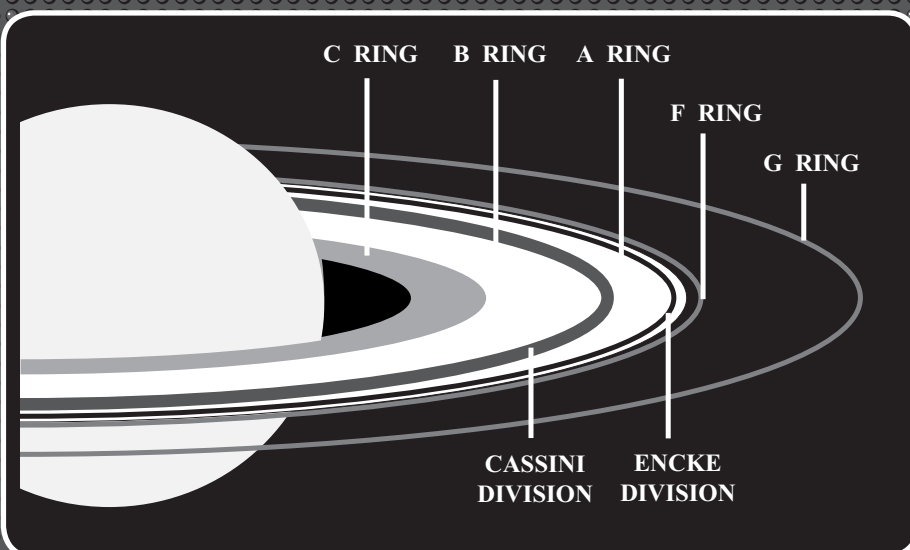
FEATURES - Like Jupiter, Saturn has belts and zones which are described by the same system. The colours of these are more subtle and the angle of the planet makes them difficult to distinguish. Occasionally, large white oval patches will appear and persist for several months. The rings obscure one hemisphere when open leading to a lack of information for several years.

RING SYSTEM

When fully open, the rings can be seen in all their glory. Ring structure can be observed and intensity estimates made.

SATELLITES - Titan, Saturn's largest satellite (and the only moon which has its own atmosphere) can be seen in small telescopes. Other moons require large instruments and the glare of the rings to be reduced. This happens most effectively during a ring plane crossing.

OCCULTATIONS - When the planet passes in front of a star, important information about the ring structure and atmosphere of Saturn (and Titan) can be gleaned by analysing how the starlight varies. CCD imaging has proved highly productive in this respect.



BELTS AND ZONES

Latitudes:

| | |
|------|--------------|
| SPR | -60° |
| STB | -33° to -44° |
| SEB | -9° to -27° |
| NEB | +12° to +30° |
| NTB | +30° to +40° |
| NNTB | +56° to +62° |
| NPR | +60° |

System I covers the equatorial belts and zone and has a rotation period of 10h 14min.

System II (the rest) rotates once every 10h 38min (in fact there is a smooth decrease in rotation towards the poles)

RECORDING OBSERVATIONS - Drawing at the telescope is the most popular way to record observations. Prepare a blank outline of Saturn using either a DTP program or templates available from the BAA showing the rings in 1° increments. As with all astronomical drawings, observe the planet for a good 20-30mins before sketching the appearance. Rapidly outline principal features and then spend more time on capturing precise shadings and tones.

A general inspection of the globe and rings of Saturn should be undertaken on each occasion the planet is observed. Points to be noted; Position and shape of shadows of globe on rings (ShGR) and rings on globe (ShRG). Any change in the position or form of the belts on the globe. Any star that appears likely to be occulted by the globe or rings (these events are very rare and may or may not be predicted far in advance). Position of any bright or dark spots within the belts and zones which appear to rotate with the planet. Any change in the visibility or any irregularity of the outline of Ring C. Any indication of a faint ring inside or outside of the principal rings. Position of any dusky patches or subdivisions on the ansæ of the rings.

Visual estimates of relative intensity from a long-term part of the BAA programme. Intensity estimates of rings, belts, zones and the various parts of these are made on a scale from '1' for the bright, outer part of Ring B to '10' which would equate to the black of a very dark sky or shadow. Caution should be exercised at an apparition where the rings are presented at a shallow angle where the outer part of Ring B is apt to appear darker than the 'assigned' value. Exceptionally, a value of '0' may be assigned to a very bright feature such as a rare, prominent white spot.

Estimates of the colour of the various belts, zones and rings are useful, especially by those equipped with large reflectors. Colour on the disk of Saturn is usually subtle but careful use of colour filters can identify tints in the belts and zones of Saturn and the Wratten range of filters are suitable for use at the telescope. Filters may also be used to investigate the *bicolour aspect* of the rings, where one ansa may appear brighter than the other when examined with say, a red or blue filter. This phenomenon is poorly understood and may vary over hours.

Large white ovals have appeared in 1876, 1903, 1933, 1960 and 1990, all in the northern hemisphere and mostly discovered by amateurs. There could be a possible periodicity of 27-30 years. When any spot is seen, a transit timing should be made when the feature crosses the CM (positions available from BAA handbook or at www.britastro.org/news/items/2002997.html).

SATELLITE OBSERVATIONS - Titan has a magnitude of 8.3 and orbits Saturn once every 16 days in the equatorial plane. Near ring plane crossings, transits of the moon and its shadow may be observed in small instruments providing the seeing is good. The other satellites are much fainter, lying between magnitudes 10 and 14 and so require large instruments. Rhea, Tethys, Dione and Enceladus are the brightest of these. Transits are best seen against the lighter zones of Saturn and many of the shadows of the distant moons are penumbral and difficult to see in transit. Again, eclipses and occultations are more likely to occur near or at a ring plane crossing, and are easier to see without the glare of the rings.

PHOTOGRAPHY - Due to the large apparent diameter of the rings, Saturn is a rewarding photographic target for fast fine grain films. To photograph Titan, a driven SLR with 400mm lens will suffice and an exposure time of between 20 and 60 minutes (the planet 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 if spots are recorded.
- Aperture and magnification of the telescope, together with any details of accessories
- Seeing conditions (Antoniadi)
- Location of observer
- Name of observer