Observing basics: III

Visual observation of Saturn

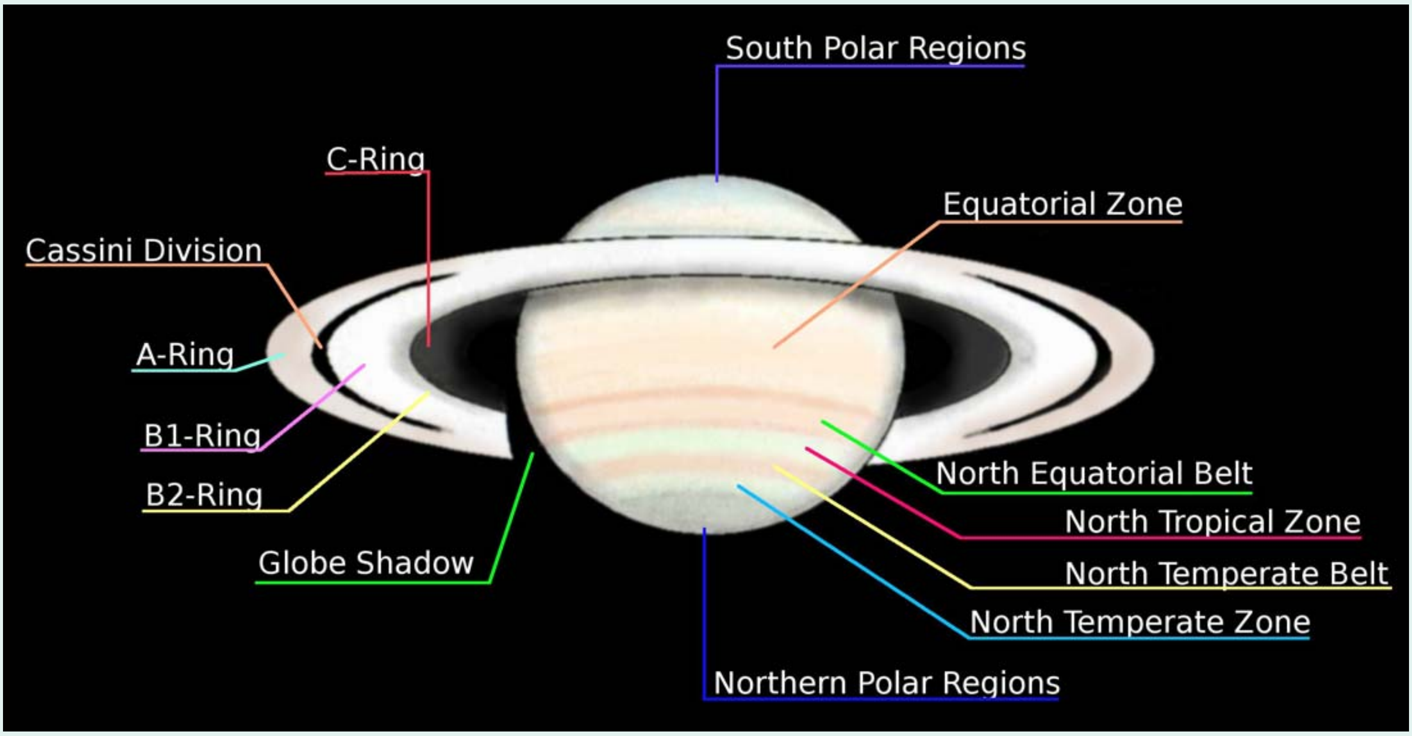

Figure 1. The various features of Saturn visible in the current apparition.

Saturn is currently easily accessible in the evening sky. Let **Paul G. Abel** guide you through making a visual observation of the planet, and drawing what you see.

Saturn has now passed opposition and is well placed in the evening sky. Although the planet is not very high in the sky, it is still easily accessible and if you haven't tried it already, then I urge you: why not try making a visual observation of Saturn, and drawing what you see?

You might think that making a useful observation of the planet requires a vast telescope, a webcam and a great deal of skill with computer processing algorithms. In fact it doesn't – it simply requires a disciplined observing ethic, some planetary blanks, a notebook and some pencils.

Observing basics is a series of articles by BAA Section Directors and other experts, designed to help you get started in observing, whether you are a newcomer to astronomy or an 'old hand' thinking of taking up a new area of interest.

Look out for further articles in the series in future issues of the *Journal*!

There is still a great deal the visual observer can contribute, and moreover, it is a excellent way for casual observers to make a start on becoming organised observers: turning your casual observations of the night sky into a meaningful scientific adventure.

Saturn: A brief overview

Saturn is one of the finest objects in the sky – the rings and huge retinue of satellites seem (to me) to give it a rather surreal quality. The planet is an easy object to enjoy, but a difficult one to observe!

Like Jupiter, Saturn is a gas giant and whenever we look at these worlds, what we are really seeing is the top layer of an extensive and rather turbulent atmosphere. Beneath this atmosphere is a massive layer of molecular hydrogen and helium. Further down, deep in the murky depths this gets 'squashed' by the extensive pressures into a very peculiar material known as *metallic hydrogen*. This gives rise to Saturn' s appreciable magnetic field. Below this there is 'probably' a small rocky core (I say probably simply because the models predict this, and for obvious reasons it has yet to be directly confirmed).

The striking belts and zones that appear on Jupiter are much more muted on Saturn. This is not because Saturn is any less dynamic than Jupiter (indeed the wind speeds are considerably stronger), it is because there is a lot of 'smog' above the belts and zones, and as a result, the features are much less well defined. The atmosphere of Saturn seems to be separated into three distinct layers. At the top of the atmosphere is a region of ammonia droplets, below that a deck composed of ammonia hydrosulphide, and the final deck beneath these two is largely composed of water.

There is a system of naming the various features visible on the disk and rings (see Figure 1). This table shows the abbreviations used:

Abbreviation	*Feature*
SPR	South Polar Region
STropZ	South Tropical Zone
SEB	South Equatorial Belt
EZ	Equatorial Zone
NEB(s)	South component of North Equatorial Belt
NEBz	North Equatorial Belt Zone
NEB(n)	North component of North Equatorial Belt
NTropZ	North Tropical Zone
NTB	North Temperate Belt
NTZ	North Temperate Zone
NPR	North Polar Region

We also have to consider the problem of keeping track of longitude. Longitude is an imaginary line joining the north and south pole. On terrestrial worlds like the Earth or Mars, fixed features have a fixed longitude; for example

'Dawes Bay' is at 0 longitude on Mars. With gas giants like Jupiter or Saturn, there is no solid surface, and since the equator of Saturn rotates quicker than the rest of the planet, this means we need more than one longitude system. Astronomers have devised three systems of longitude for Saturn:

System I:	The equatorial regions; everything between the SEB and the NEB
System II:	Everywhere else
System III:	The rotational period of Saturn's magnetic field.

In earlier times, one had to calculate the central meridian (CM) longitudes manually. Today however, help is at hand with the magnificent free software *WINJUPOS*. Type in the date and time of your observation and *WINJUPOS* will give you the three longitudes.

Observing Saturn

To make a serious start on observing Saturn visually, a telescope of minimum aperture 130mm is required. A 150mm 'scope will show a lot of detail, and a great deal of serious work can be undertaken with 200mm aperture and larger telescopes.

The primary objective of visual observation is to make a drawing. Contrary to popular belief, this does not require artistic skill any more than does making a circuit diagram! What is essential is objectivity and lots of practice. You will find that the more you look, the more you will be able to see; observing is a feedback process and the human visual system can become quite accurate and reliable given time and practice.

In order to make a drawing, you will need a Saturn blank. (I don't recommend drawing Saturn freehand as the number of accurate ellipses required is substantial!) Use the BAA *Handbook* (or *WINJUPOS*) to look up the value of 'B'. This number represents the amount Saturn is tilted towards us (it is called 'declination of earth' in *WINJUPOS*). At the moment, the northern hemisphere is facing us, and at the time of writing B= +13.3. So if I wished to make a Saturn drawing tonight, I would go to the Saturn Section website and download and print the observation form for B= 13.

Before you begin drawing, you need to find the right magnification for the night. I normally use powers between ×167 and ×312 – a power of ×250 being the most frequently used. You must find a magnification whereby the image of Saturn is sharp and clear. There is no point in using ×500 if all you can see is a steam pudding quivering merrily in the eyepiece!

Once you have Saturn in the field, don't rush to make a drawing. Instead spend about 10 minutes looking at what is there, and build up a mental picture of the details present. Once you have done this, begin drawing in the details. Remember, Saturn spins rapidly, so you must not take any longer than 15 minutes drawing the planet otherwise the quick rotation will make it inaccurate. I spend the first 6 to 7 minutes putting in the obvious features, then I note down the time in UT, and spend the last few minutes filling in the fine details.

I cannot stress enough that it is important to keep a proper record of your observations, ideally a hardbound notebook (something which won't fall to bits the minute you take it outside). With each observation, make sure you include the date, time, instruments used and magnification along with the CM longitudes as noted above. It is also desirable to record the seeing and weather conditions.

I usually make two drawings, one at the telescope (which I annotate), and then a neater colour version once inside. Always send your observations to Section Director Mike Foulkes – there is little point in having them just sit in your book. I use a scanner to transfer the drawings from the book into electronic form.

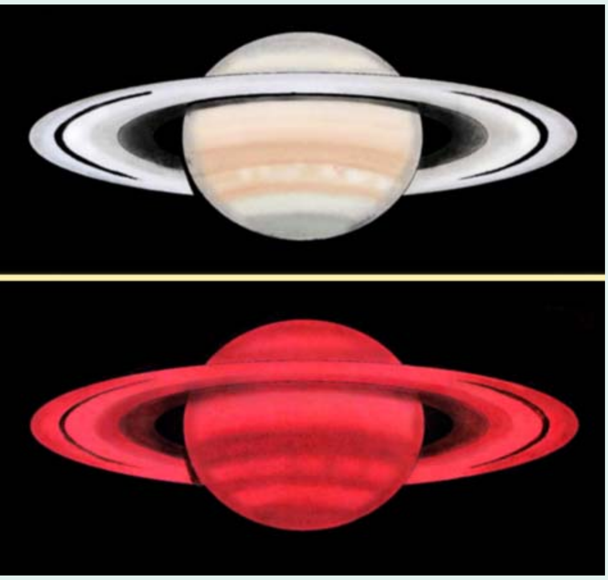

Figure 2. Two recent drawings of Saturn made on 2012 April 11 with the author's 203mm reflector. *Top:* Integrated light, 00:38UT, ×250. CM1: 332; CM2: 113.3; CM3: 39.9. *Below:* W#25A red filter, 02:08UT, ×312. CM1: 24.8; CM2: 164.1; CM3: 90.6. *Paul G. Abel.*

Other work

Disk drawings are not the only thing the visual observer can do; there are also intensity estimates and filter work. Intensity estimates are a useful way of tracking changes in brightness of the various features. Using the BAA scale of 0 (very bright) to 10 (dark sky), simply assign each of the various belts, zones and ring components you can see with a number between 0 and 10. Make sure you note the time when you have done this, and over the course of an apparition you will find slight variations in the various features.

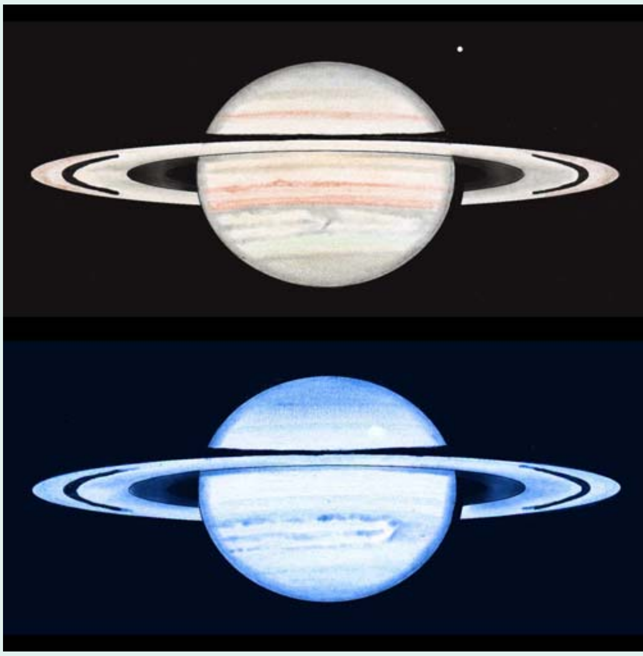

Figure 3. Drawings of Saturn with the Dragon storm, 2011 May 12, 203mm reflector. *Top:* Integrated light, 22:25UT, ×167. CM1: 152; CM2: 284.5; CM3: 254. *Below:* W#80A blue filter, 23:22UT, ×167. CM1: 184.9; CM2: 316.1; CM3: 285.6. *Paul G. Abel.*

Filter work is also another interesting avenue to explore. With the planet being low in the sky, I find that a red W#25A filter helps to steady the view in poor seeing. You will also find various features stand out better in different wavelengths of light. For example, orange features come out well in a blue filter, and the brightness of the zones is noticeably different in a blue filter rather than a red one. I have been making intensity estimates of features both in unfiltered light, and in red and blue light over the course of a few years.

Finally we come to storm monitoring. Although Saturn is generally quiet, with storms appearing seasonally, the recent Dragon storm of 2010–'11 has demonstrated that Saturn can produce large dynamic storms without warning. Such events provide us with an understanding of the dynamics and jet streams of the Saturnian atmosphere. Storms can take the forms of white ovals (large and small), and the large storms tend to disperse and brighten the zone they are in. Filter work can help emphasis different aspects of these storms, and during the 2010–'11 apparition I made a number of drawings with a W#80A (blue) filter showing the changes undergone by the Dragon storm.

If you decide to have a go at visual work you will not be disappointed. You will discover a whole new way of looking at astronomical objects, and if you later decide to pursue imaging, you will find the lessons learned at the eyepiece very valuable indeed.

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