

The quarterly magazine of the SPA
January-March 2004

Popular Astronomy

Splendid aurorae
Sharp imaging with AstroVideo
Stellar evolution
Spectroscopy explained
Light pollution report
Martin Rees interviewed
Astronomy basics

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Production

Editor

Peter Grego
79 Chadwick Avenue
Rednal
Birmingham B45 8ED
editor@popastro.com

Advertising Enquiries

Peter Grego

Distribution Manager

Barry Turvey
36 Fairway
Keyworth
Nottingham NG12 5DU
membership@popastro.com

Printers

Steatham Printers
Planks Lane
Wombourne
Wolverhampton WV5 8EB

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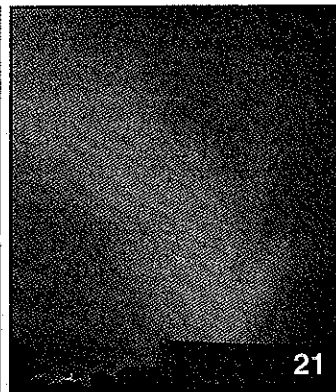
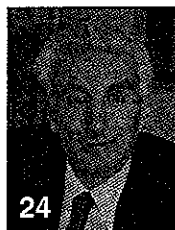
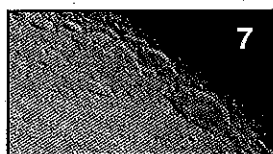
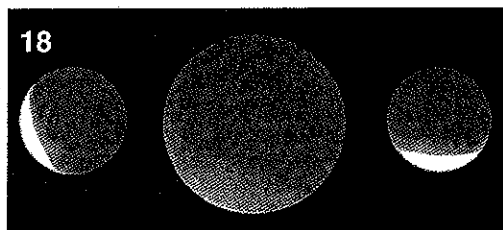
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The Secretary
36 Fairway
Keyworth
Nottingham NG12 5DU

Cover: The spectacular aurora of 29 October 2003 was imaged at 22:26 by Paul Andrew of St Margaret's at Cliffe, Dover, using a Canon 10D digital body with a Sigma 15 mm EX full-frame fish-eye lens. 30 sec exposure at f/5.6 with the camera set at ISO800.

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Some astronomical basics

Expensive optical equipment and advanced mathematical skills are not needed to learn the basics of astronomy. MEHRYAR NOORIAFSHAR offers some helpful advice

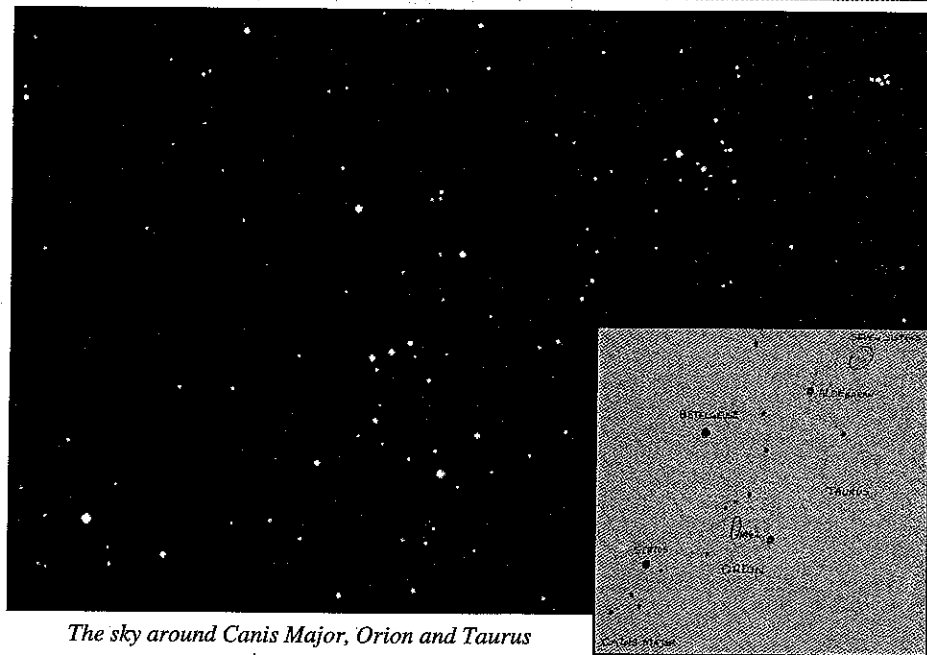
EQUIPPED only with a pencil, paper and possibly a pair of binoculars, a beginner can start learning the basics of astronomy, and appreciate and enjoy some of the splendid views that the skies have to offer.

Equipment for practical stargazing. Many people wrongly think that the magnification delivered by a telescope is most important. But magnification is not as important as the instrument's light gathering capabilities. Unfortunately, many people buy a 'powerful' but inexpensive telescope with the hope of seeing all those mysterious celestial objects in full colour. Pictures on the telescope boxes don't help this problem either! A good telescope is an invaluable tool for the serious observer, and the larger its lens or primary mirror, the better its light gathering capabilities. However, as the diameter of the lens/mirror increases, the cost of the instrument increases considerably.

When I became interested in astronomy, I was advised by a few experienced astronomers that a pair of binoculars would be valuable for casual and enjoyable observations. I also remember hearing the same advice on Patrick Moore's *The Sky at Night* TV programme back in the '70s. Giving this advice to any beginner would be a good start. A pair of 7x50 (7 times magnification and 50 mm diameter of the objective lens) binoculars are an excellent instrument. They are inexpensive, lightweight and highly portable. You can go for higher magnifications, but 7x50s do not sacrifice clarity for magnification.

What special skills are needed? There is no doubt that mathematics and related subjects play an important role in astronomy. To fully understand and appreciate the complexities involved with the movements, sizes, distances, magnitudes and relationships between celestial objects one must use mathematics and related subjects. However, astronomy may also be learnt and enjoyed in a very practical manner without relying on too much mathematics. Although theory is very important in any subject, conveying the general principles and underlying concepts to the learner initially by using practical examples is a more effective way of facilitating learning. It also enhances learning and makes it more interesting. For instance, we can demonstrate the importance and role of statistics (as a branch of mathematics) in astronomy by means of the following analogy, one which I often use in my statistics lectures:

"Imagine that you wish to find out if there is life in the other parts of the Universe. How would you approach it scientifically? Think about the vastness of the Universe. Can we scientifically prove that there are planets like ours belonging to some of the other Solar Systems? You may have heard of new planetary systems outside our Solar System. Scien-



The sky around Canis Major, Orion and Taurus

tists and astronomers have detected possible planets rotating around some stars by observing the wobbling effect on those stars, probably being caused by the gravitational pull of planets revolving around these stars. So far, no scientist or astronomer has actually seen these planets. One day it may become possible to do so!

So, can we scientifically conclude that we are or are not alone in the Universe? Maybe not. However, we may demonstrate, statistically, that the chances are very high. If you are told that it is estimated that there are at least 1 billion galaxies in the Universe and an average galaxy may contain about 1 billion stars; then (based on those very high numbers) you can deduce that the chances of having similar Sun-like stars with Earth-like planets are reasonably high."

Hence, we may provide an answer to a difficult question using only the general concept of statistics without delving into complex formulae and theories. We may adopt a similar approach in understanding a number of other concepts too.

Practical stargazing. The sky charts for the examples given have been drawn by hand and are based on real observations. Beginners are encouraged to do the same, as it reinforces learning and helps with remembering in a very practical way. One of the most prominent and easily recognizable constellations in the sky is Orion. It is easily observed from both the northern and southern hemispheres. Don't forget that what a southerner sees is the inverse of what is seen in the northern hemisphere. From the north, it looks like a muscular hunter with a narrow belt represented with three stars. The hunter's sword is represented by the Orion Nebula (M42), which is located below the belt. The

nebula (a vast cloud of gas), about 1,000 light years away, is visible with the naked eye as a misty patch. The Orion Nebula is just like a nursery where new stars are being born. When you look at the nebula, remember that what you see has taken 1,000 years to reach us! In Orion we will find Betelgeuse (a red supergiant) and Rigel (a white star)—compare their colours. Orion can be seen with Canis Major (the Great Dog) and Taurus (the Bull) on either side. The constellations dominate the southwestern sky in the northern hemisphere during the winter, and the northeastern sky in the southern hemisphere during summer nights.

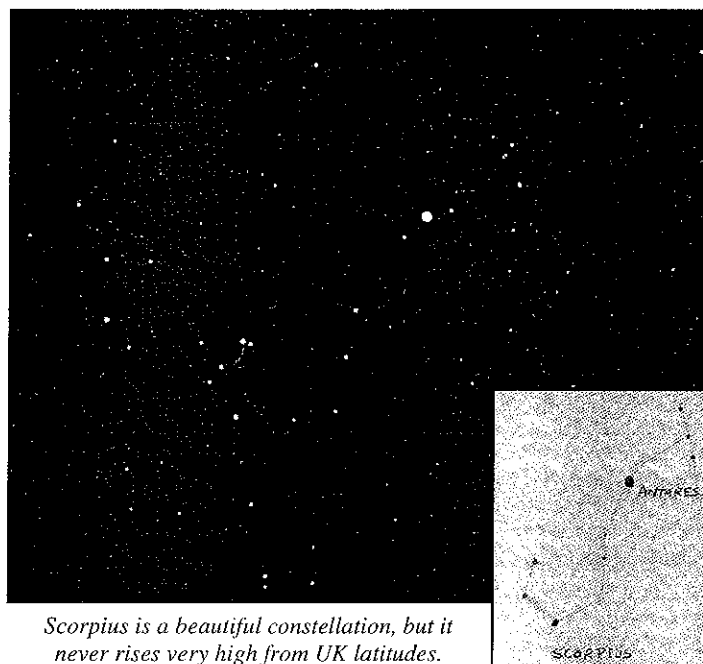
If you draw an imaginary line through the three stars of Orion's belt and extend it to the left (in the northern hemisphere) you will find Sirius, the brightest star in the sky. Sirius is only 8.4 light years away—if at some point in the future we eventually develop the capability to travel at the speed of light, then it will take us 8.4 years to reach this star. From these northern latitudes, Sirius is too close to the horizon to be completely free of the effects of atmospheric turbulence which produces scintillation, when the star appears to flash a variety of colours. If Sirius is viewed from southern latitudes when it is high in the sky, it shines a pure white colour.

The main star in Taurus is called Aldebaran. If you draw an imaginary line between Betelgeuse and Aldebaran and extend it about two-thirds the distance between these two stars, you will encounter the Pleiades (M45), a bright open star cluster commonly known as the Seven Sisters. Can you count seven stars in this cluster with the naked eye? It makes a good eye test. The Pleiades actually contains about 200 stars. Point your binoculars towards the Pleiades—it makes a wonderful sight.

Scorpius (the Scorpion) is another magnificent constellation to observe. In the southern hemisphere, Scorpius appears high in the southeastern sky early in the winter evenings. In the northern hemisphere from UK latitudes it can be seen low, just above the southern horizon late on summer nights. Unfortunately, Scorpius is a little too low from the UK, but it is visible in its entirety just above the horizon from southern Europe (Portugal for instance). Scorpius is a great constellation to view, and talk about. It is called Scorpius because it looks like a scorpion (one of the oldest species on Earth). Being a southern hemisphere resident, I observe this zodiacal constellation in the winter—its shape reminds me of an inverted question mark, and I wonder if a question about the Universe is being asked? The main star in Scorpius is Antares (Alpha Scorpii). The name Antares is derived from the Greek and means the 'rival of Mars'—the name was likely given to it probably because of its red colour. If you get the chance, try to observe Scorpius through a pair of binoculars

Once you become familiar with the position of these constellations in the sky, keep on observing them, and try drawing them too. Your drawings do not have to be a hundred

percent accurate—they should reflect what you see. It might help if you carry out your observations from the same spot, and using nearby plants and structures as references might be a good practical approach at first. So, it is possible to learn some basic astronomy and enjoy it as a hobby without being overwhelmed by mathematics and relying on expensive optical instruments. Casual observations of familiar objects on a regular basis with the naked eye is perhaps one of the most relaxing and practical ways of appreciating the night skies. Every time you look at the constellations, remember that they are not just a collection of shiny dots that decorate the 'ceiling' of our skies—they are made up of



Scorpius is a beautiful constellation, but it never rises very high from UK latitudes.

relatively nearby stars within our Milky Way galaxy, at a variety of distances in space. They are all different sizes and colours and at different stages in their life cycles. Some of them have planetary systems, and a few of these planets may even harbour life itself. *PA*

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Linda Simonian, The Planet:Earth Centre, Swallows Barn, Bacup Road, Todmorden, Lancashire, OL14 7HW. SWITCH payment is now also accepted. Phone 01706 816964. Email theplanetearthcentre@btinternet.com