

Eternal fire

Our ferocious star

In the mind-stretching vastness of space the Sun is a very near neighbour. Solar radiation, the energy that powers the Earth and makes life as we know it possible, takes approximately 8.5 minutes to travel the mere 150 million kilometres to Earth, whereas light from the next-nearest star takes years.


The Sun is classified as a “yellow dwarf” because, in cosmic terms, it is a relatively small star. It was born 4.6 billion years ago as swirling clouds of interstellar gas and dust coalesced, drawn by gravity. As this new star grew, its gravity reached a point where hydrogen at its centre was crushed under enormous pressure, triggering a nuclear fusion reaction that converted hydrogen to helium. It is this reaction that is the source of the Sun’s energy and it will be so for another 5 billion years or thereabouts until the Sun exhausts most of its nuclear fuel. At this point, in its death throws, it will rapidly expand to become a “red giant”, engulfing the inner planets including Earth.

For centuries the Sun was seen as a white, featureless disc until techniques were developed that allowed more detailed observations.

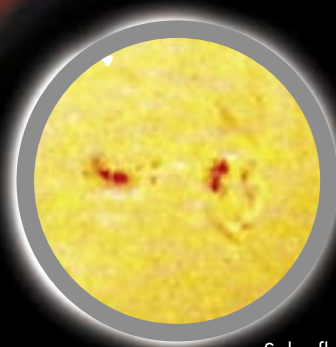
Temperatures in the Sun are so high that matter as we know it cannot exist. The material of which it is composed is known as plasma: charged particles that in the cooler regions of the universe form atoms and ultimately the familiar materials that surround us on Earth. These particles are in constant, violent motion and produce magnetic fields of enormous strength. The phenomena we can observe in the Sun – sunspots, solar flares, prominences and storms – are all products of the interactions between the magnetism and plasma of this violent, restless world.

The frequency of sunspots varies over an 11-year cycle. During recent years, since about 2000, some of the most violent solar events in recent decades have occurred. Giant sunspots many times the size of Earth have made their appearance as “naked-eye” spots – that is, they can be observed directly (with appropriate eye protection) or by telescope projection techniques. In 1947 the largest sunspot ever recorded covered an area of 25 billion square kilometres.

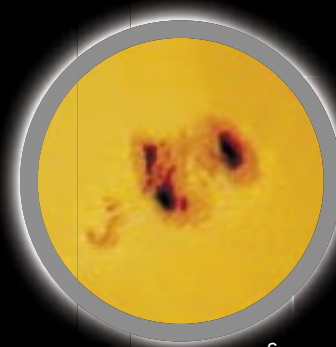
In April this year one of the largest outbursts in 20 years erupted from a huge sunspot that produced a gigantic solar flare. Solar flares can affect radio and satellite communications and disrupt power supplies. These outbursts of energy cause auroral displays. Seen in the southern skies, they can vary from a faint background glow to a multi-coloured display of ripples, fire-curtains and searchlight beams that create a wonderful “laser-light” show.

A recent report suggests that the Sun is more active now than during the last century or so. 

Prominence with solar rim,
photographed using coronagraph



Solar flare



Sun spots

“Good seeing” = astronomy for everyone

Amateur astronomers can make an important contribution to the science of the stars.

Think of astronomy and it is quite likely that images of enormous radio dishes, the Hubble space telescope or some other “big science” research program comes to mind. Think of amateur astronomy and it’s easy to imagine some hardy soul under a clear and freezing night sky enjoying a somewhat anti-social hobby, pursued for pleasure; great fun, perhaps, but not mainstream science.

Not so. Amateur astronomers make a valuable contribution to the science of astronomy. Amateurs are frequently the first to report new comets, supernovae and asteroids. The data they collect, for example, on occulting stars (one star passing in front of another) or information on “variables” (stars that

vary in brightness) make an important contribution to astronomy.

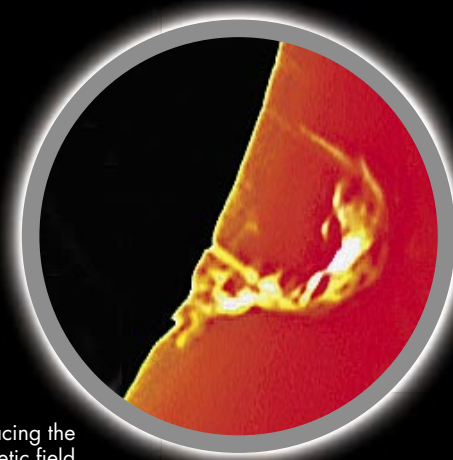
The Earth has endured catastrophic impacts from chunks of rock arriving from space at enormous speeds. Many scientists believe that it was just such an event that caused the extinction of the dinosaurs. The amateur eyes in the sky searching for new asteroids, comets and the smaller bodies that lurk with unknown trajectories in space are part of a the constant search for objects that may be on a collision course with Earth. There is serious discussion that technology may have advanced to the point that it might be possible to deflect an incoming chunk of matter and prevent an unimaginable catastrophe. Early detection is the key.

Modern technology has made available highly sophisticated equipment at relatively modest cost. Around the

Observing the Sun

Observing the Sun requires certain precautions if we are not to permanently damage our eyesight. However, with the appropriate equipment, observing and photographing the Sun is a very rewarding daytime aspect of astronomy. During the two weeks that sunspots cross the face of the Sun they can undergo remarkable changes both in shape and size. It is easy to observe and record these changes either with sketches or better still with a simple digital camera and a small telescope fitted with an aluminised solar filter over the front lens of the telescope.

Observing the Sun has one great advantage for all astronomers, particularly amateurs: it’s a daytime occupation!



Arched prominence tracing the
intense solar magnetic field



Aurora, showing coronal swirl, southern Tasmania, November 2004, a few days after a violent solar storm

world many amateur astronomers own and operate equipment that 20 years ago would have been out of reach for all but the largest organisations.

Tasmanian-based Shevill Mathers has been an amateur astronomer for much of his life. He has spent many years in the pursuit of imaging excellence and developing new techniques to both record and display astronomical events with the objective of making astronomy more accessible to the wider community. His Southern Cross Observatory was established in 1969. Recently he acquired a special instrument for making detailed observations of the Sun. This instrument is a Solar Coronagraph Mark IV from the Baader Planetarium in Germany.

Amateur astronomer Shevill Mathers



This instrument, when fitted to a standard 102-mm (4-inch) refracting telescope, produces an artificial solar “eclipse”. This allows observation and photography of the fine prominences erupting around the edge of the Sun’s disc. These fiery outbursts of solar energy extend for huge distances out into space but are not bright enough to be seen against the intense luminosity of the Sun.

The coronagraph works by blocking out the disc of the Sun with a very precisely made and highly polished cone, centred in one of the front lenses of the instrument. (A set of six cones is required to compensate for apparent changes in the Sun’s diameter throughout the year.) The idea is to leave a minute rim with the prominences clearly visible. The telescope must be aimed with extreme precision to keep the Sun’s disc centred on the cone to produce this artificial solar eclipse.

The only one of its kind in Australia this instrument is at the most southerly location in the world. At many other sites these instruments would be virtually useless because of the high level of pollutants in the atmosphere. The conditions here enable the production of the very high quality images reproduced in this article. 📷

Further information

Because of its latitude and very low levels of atmospheric pollution, Tasmania provides many opportunities for good “seeing”. Tasmania’s amateur astronomers are uniquely placed to make a significant contribution.

If you would like to know more about observing the Sun or any other celestial object, then contact your local astronomy club or society, where you will find members keen to assist the newcomer.

The Astronomical Society of Tasmania Inc.’s website provides all the information you need. Host society members’ images and equipment are found at:
www.ast.n3.net and
www.taao.has.it.

If you would like to check the daily state of the Sun’s activity then log on to www.spaceweather.com

Southern Cross Observatory, Cambridge

