Astronomy under the Southern Cross

Australia's international standing in astronomy is increasingly built around two telescopes on a spectacular escarpment on the edge of the Great Australian desert.

Coonabarabran. The Southern skies are different, and much more spectacular. The Milky Way is more luxuriant than in the north; before midnight last week it conveniently ended in the distinctive bulge of the Galactic Centre just above the horizon. To northerners, the Large Magellanic Cloud, lying above the Galactic Centre, is startlingly made conspicuous by its unfamiliarity. So is the Southern Cross, and the dark patch (representing obscuring dust and gas) that it encloses.

All this is clear to the naked eye, without artificial aids except perhaps for spectacles. One night last week, an astronomer casually remarked that if astronomy had been founded in the Southern Hemisphere, it might not have taken as long to figure out that the Sun is but one of 100 billion stars in a disc-shaped galaxy. There are all the pieces of the Universe stretched across the sky!

But these are exceptional circumstances. The small township of Coonabarabran is 20 km away from the edge of the escarpment on which are perched more than half-a-dozen telescopes, among which the Anglo-Australian Telescope (AAT) is the most powerful. The others are the Schmidt Camera, first established by the British Science Research Council (now the Particle Physics and Astronomy Research Council), but now jointly owned with Australia. But the escarpment also houses the Siding Spring facility of the Mt Stromlo and Siding Spring Observatories of the Australian National University (ANU) at Canberra.

One remarkable feature of the escarpment is the way in which the rocks are studded with extinct volcanic cores, like Easter Island sculptures but on a truly gigantic scale. The altitude may be less than on Hawaii or in the Andes, and the weather less predictable, but the 'seeing' can occasionally be exceptionally good. Last week, observers were whooping with delight at the precision of the profile of a stellar image on a television screen, showing dispersion over only a fraction of an arc-second. "We do not always realize how good the seeing can be", said the director, Dr Russell Cannon.

The rest of us do not always realize what observers put up with — the spartan sleeping accommodation, the unfashionably early evening meals (so as to make the best use of the autumn night) and the semidarkness in which people work (so as to keep stray light to a minimum and to make adaptation to the dark easily attainable). And then there are the long hours at the recording equipment and the frustration when a clear sky fills with cloud.

Otherwise, being an observer is often now no different from working in a laboratory anywhere. Although the AAT is equipped with a barrel-like cage into which an observer can clamber to spend the best part of a night, most people spend their telescope-time as data-gatherers, monitoring the recording equipment and only occasionally having to adjust the telescope so that the image of their star falls squarely on the slit of their spectrograph.

On the instrumental side, both telescopes are being used to push forward the technology of measuring simultaneously the spectra of several stars in the field of view. The incentive is the recognition that it is wasteful of the power of a telescope collecting light from some area of the sky to use it simply for recording the spectrum of the light from a single star, essentially throwing away the light from all the others visible. The idea is to place a single optical fibre exactly where the images of several stars should be. The fibres then feed the light from their respective stars to different points along the length of a spectrograph, yielding as many spectra as there are fibres. The technology is as fiddling as it could be; the ends of the fibres have to be dead-flat, and must be checked by interferometry. "It's different in communications", said one astronomer. "They can always amplify, but with us, if we lose a photon it's gone for good."

Last week, a woman graduate student from Lyons and a woman postdoctoral fellow from Australia were practising the craft (a little like embroidery, with all the fibres hanging loose) of cementing tiny prisms (at the end of optical fibres) to the surface of a glass plate in exactly the positions specified by an optical photograph of the patch of sky in question, conveniently displayed on a monitor. But the AAT is now building a machine to do the job automatically. There will be an array of 1,000 optical fibres, whose flattened ends will be positioned (in groups of 400) so to yield more than 1,000 spectra in a few hours of good seeing.

Even as things are, a Cambridge-based postdoctoral fellow (another woman) was boasting last week that six of nine quasars turned up by such an exposure were apparently novel, not in the machine-based catalogues to which such observations are referred.

People are delighted with the two telescopes, and with the 3.9-metre AAT especially. The pointing accuracy and stability are especially good, so much so that people are fearful of replacing the now obsolete computers with more modern equipment for fear of throwing a software spanner in the works. The latest project is to extend the field of view of the telescope to 2 degrees by fitting correcting lenses just before the prime focus of the telescope to correct for aberration at the edges of the present field of view. Again, the incentive is to wring as much information as possible from the light-collecting capacity of the telescope, but Cannon is also delighted that the AAT will be able to span the Southern Cross.

By its design, the 60-inch Schmidt camera is a different animal, originally placed here because of the need for a survey of the Southern skies. It has won its now-international reputation through the development of an emulsion (called '380') whose resolution is superior to those previously available. The benefits are obvious in the plates it yields, over a field of view seven degrees across. On the contact prints, it is as if a fine dust of spherical and elliptically shaped particles had been scattered on a sheet of clear plastic. Palomar is now said to be getting results as good in its second complete survey of the sky.

Between them, the two telescopes have given Australian optical astronomy a powerful impetus, even if radioastronomy remains its strong suit. Apart from the traditional bastions of Sydney and the ANU, other universities (such as Melbourne) are now building departments of astronomy. Opinion is divided about (but is mostly in favour of) an Australian application to join the European Southern Observatory, while Britain is no longer a reluctant partner in the two telescopes on this site. Indeed, the research council has just agreed that it will pay its half-share of the expenses for the coming five years.

None of this is a great surprise, given that the splendour of the Southern skies is a perpetual recruiting-sergeant for astronomy and all its works. It is noticeable that those in the trade, when well away from telescopes, are given to leaning their backs against the sides of their motor-cars and gazing upwards, as if to check that the Magellanic clouds are still there, and in their correct positions. **John Maddox**