3: This false-colour image of the barred spiral galaxy NGC 7479 was the very first observation taken for a school by the NSO. It was created by the pupils using the LTImage software. (NSO and Saints Peter and Paul Catholic High School, Widnes)

4: Schoolgirls during the launch of free registration for the NSO. (Liverpool John Moores Uni.)

of choices offered by the NSO is restricted to a number of observing programmes and objects that we know will meet the needs of the users.

This is necessary because the vast majority of teachers have no direct experience of large telescopes and so cannot be expected to understand the powers and limitations of these huge instruments. The technicalities of fields-of-view, filter selections, maximum and minimum exposure times, brightness, extended and point-like objects and so on are not what we want them to be worrying about. Therefore, through Go Observing the user is guided through a series of questions (Would you like to make a measurement? Would you like to discover something? Would you like to get a pretty picture? and so on) that lead to a choice of objects from our extensive hand-picked database and so to a set of observations. These requests are then passed to the telescope for observing that night. Those who want a more direct experience of controlling a telescope "live" should look at the Faulkes Telescope project (described on pages 4.16–4.18 of this issue), which uses two more TTL-built telescopes in Hawaii and Australia.

This way of working is as close as we can make it to how professional astronomers work with the telescope: deciding on a question to answer, planning the observations, getting the telescope to carry them out and then analysing the results. In this way the pupils and teachers can get a feel for how science actually works and can also share in the excitement of working alongside the professionals.

Making it real

Of course there is always the risk that this process will be too remote from a pupil for it to really inspire them. However, by providing plenty of information about the progress of their observation, far from being disconnected, the children can get deeply involved in the observation: keeping an eye on the weather on La Palma (via our dedicated weather station), checking each morning to see whether their observations have been carried out, examining all-sky photographs taken with their observations to look for possible problems and, finally, analysing the observation itself (of which more below).

To enhance this, each pupil can be given their own personal username for the NSO and so can take their own observations from home, making the system suitable for anything from whole-class teaching, to stimulation of individual pupils or supporting science clubs.

Not just a pretty picture

Naturally, the observation itself is the core of this, but once it has been taken, the excitement and education has only just started. Part of the educational power of astronomy comes from the stunning images that can be taken, but observations from professional telescope are far more than just pretty pictures (although they can be very pretty indeed!).

The next stage, therefore, is to load the observation into our specially written image-processing software "LTImage". This combines the power of professional data-analysis software, with an ease-of-use that makes it suitable for all pupils from primary right through post-16 education (indeed, some of my colleagues now use it). As well as allowing the pupil to explore the full dynamic range of the image though scaling and false-colour schemes, the software also, crucially, makes it possible to make measurements – which is where the science really starts.

The size of an object can be measured, or its brightness. Multiple observations can be compared easily showing changes (for example to find your own asteroid or see the shadows on the Moon change with time). Developments in the pipeline will allow multiple observations to be combined to make "true colour" images showing the rich variety and beauty of the heavens.

With this potential for analysis of the observation data, we have also created a series of worksheets and projects that students or teachers can follow to guide them through the possibilities and, hopefully, lead on to experimentation of their own (the software can also be used at home by the pupils – or their parents!).

Working together

At this point when explaining the NSO to schools and teachers, it is usual to hear the tentative query: "So, how much does this cost?" Fortunately the answer is easy: nothing. Thanks to LJMU support, the NSO, the software and access to the telescope is now freely available to all UK and Irish schools – they just need to register on the website. Also, because of the sophisticated scheduling algorithms used by the telescope, we do not need to put any restrictions on the number of observing requests – every pupil can request as much as they wish in the confidence that the observation will be carried out as soon as possible (weather permitting of course).

The same scheduling system also means that we can carry out complicated, time-critical programmes such as monitoring of variable stars, or searching for asteroids or extrasolar planets. For these more extensive programmes we have set up a "Universe Laboratory" where each school or pupil can add their own contribution to a much larger collaborative project.

These projects also give the exciting opportunity of taking part in real research projects. So far we have had pupils monitoring the change in brightness of a distant blazar, searching for asteroids and even trying to discover an extrasolar planet.

Such collaborative projects are particularly exciting as they not only bring professional astronomy right into the classroom, but also show to pupils the importance of working together – a vital part of modern science, but one which is normally very difficult to get across in school, where the erroneous image of a lone boffin in an observatory often holds sway.

Open to all

The NSO is now a fully operational educational resource. With more than 800 schools registered and nearly 8000 observing programmes under our belt, things are starting to build up nicely.

We have also been able to widen our scope considerably. As well as giving access to the LT, the NSO website is full of a wealth of educational resources suggested by our teacher working groups. These range from a simple online astronomy textbook, through tools for studying the seasons or the phase of the Moon, to interactive models of the solar system and much more.

We are are also able to address a wide range of schools, ages and subject areas. As well as science specialists, we have talked to mathematics, ICT, art, religious education, foreign language and English teachers, and all ages from primary through to further education.

The general public are not excluded either. Through our connection with the new Spaceport astronomy and space visitor centre on the banks of the Mersey, we have helped to bring the universe to many more people and, of course, the website is open to all and much used by people all over the world (the tools to calculate sunrise and set times are particularly popular). Our experiences while creating the NSO have also fed into the development of a suite of distance learning courses for adults (including one especially for teachers).

In recognition of this wide range of opportunities that we are opening up, LJMU was recently awarded a Queen's Anniversary Prize – evidence that this really is a resource that can inspire a whole new generation.

Onwards and upwards

But what of the future? While we are pleased with the uptake and use of the NSO, there is still much to be done. The range of observations available through Go Observing is always increasing, as are the supporting workshops and projects. We also want to expand to support other areas, in particular special needs education, and also teachers who are not necessarily subject specialists and lack the confidence to plunge into the world of robotic telescopes. In all this we are both supported and pushed by our external advisory board and a dedicated group of teachers from around the country who keep us on track and firmly attached to the real world.

So, this is a very exciting time for us at the NSO and also, hopefully, for those who are are using the LT in their schools. By following our guiding motto of "motivate, encourage, support" we hope that we can help more and more people discover that the sky really is not the limit at all. ●

Dr Andy Newsam, Director, National Schools' Observatory, John Moores University, Liverpool, UK.

WEBSITES

- **NSO** http://www.schoolsobservatory.org.uk
- **Spaceport astronomy and space visitor centre** http://www.spaceport.org.uk

Listen to Jodrell

The Jodcast is a downloadable audio programme – a podcast – produced by astronomers at Jodrell Bank Observatory and is the first regular astronomy podcast produced in the UK. It was created in January 2006 by Stuart Lowe, Nicholas Rattenbury and David Ault, to exploit the new format and technology of MP3 audio to reach young people with an interest in astronomy. It also aimed to provide a UK perspective to the then existing US-based astronomy podcasts.

The Jodcast is truly a team creation, with contributions from Megan Argo, Ian Morison, Tim O'Brien and several PhD/MSc students based at the observatory,

which adds considerable variety to the show. The twice-monthly programme features regular in-depth interviews with astronomers from all over the world, the latest astronomy news, what you can see in the night sky and answers to questions sent in by listeners. Through word-of-mouth it now has a regular audience of around 1000 from all over the world. Keeping their eye on this global audience, the team also releases the monthly news segment in French, Portuguese, Chinese and Farsi.

At the end of 2006 we applied to PPARC's Small Award Scheme for Public Engagement of Science to finance some dedicated recording equipment to replace the cheap microphones we were using. We also applied for funding from the Institute of Physics to produce an anthology of the best bits from 2006 to be sent to schools for their use in teaching astronomy and physics. We won both of these grants and now have a "Best of 2006" CD which is currently sent to schools on request.

The team strives to make The Jodcast an informative yet informal astronomy resource for teachers, students and the general public. If you have any comments on, or wish to contribute to The Jodcast, please visit the website and email your thoughts: http://www.jodcast.net

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Reaching out through the heliosphere

There is a range of UK outreach activities associated with the International Heliophysical Year (IHY), which was launched in February 2007. The IHY is a programme of research and outreach events based around the Sun and its effects on the solar system. The IHY also celebrates the 50th anniversary of International Geophysical Year (IGY). The aim of IGY in 1957 was to understand the Earth's atmosphere and oceans and it required scientists from countries all over the world to co-ordinate their efforts.

The IHY expands the science of the IGY out into the solar system. Scientists and engineers from the member states of the United Nations are participating in an international campaign to learn more about the Earth, the Sun and our space environment. As well as the programme of international scientific research, a key objective of IHY is to celebrate the beauty, relevance and significance of space and Earth sciences to the world. As part of the IHY theme, Jim Wild (Lancaster University) presented www.sunearthplan.net – a public-facing website celebrating the UK's pivotal role in international space science and its relevance to the IHY. As well as showcasing IHY research, this new website provides information of IHY events in the UK and IHY-related resources.

Lucie Green, Mullard Space Science Laboratory