www.astrosociety.org/uitc

No. 57 - Spring 2002

A Taste of Real Astronomy — The ESA/ESO Astronomy Exercises

Today, most big science projects are impossible to take on by a single research group or university. The expense makes collaborations and partnerships a must. The Hubble Space Telescope is jointly run as a partnership between the European Space Agency and NASA. The worlds largest optical-infrared telescope, the Very Large Telescope or VLT is located in Chile and operated by an intergovernmental research organisation called ESO, the European Southern Observatory. For more information on the European contribution to the Hubble Space Telescope go to: http://hubble.esa.int and for more on the VLT go to: http://www.eso.org.

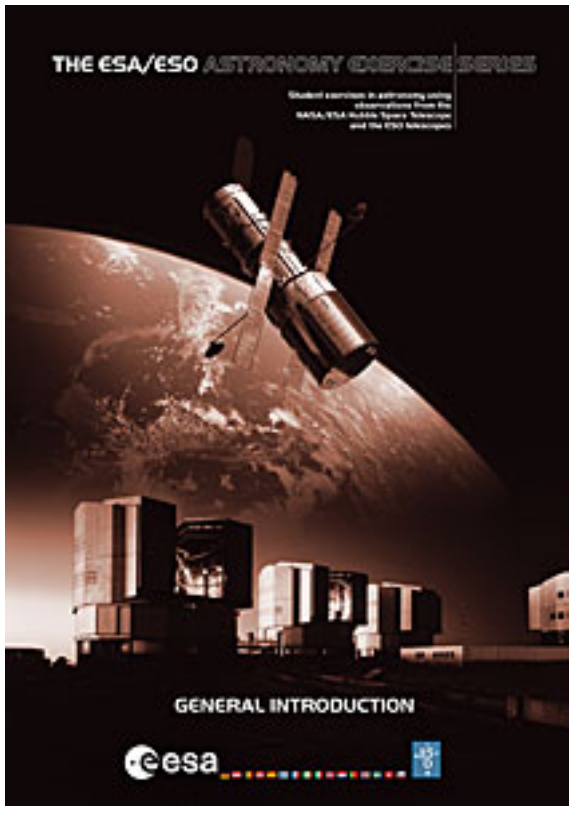
This issue of "The Universe in the Classroom" is contributed by astronomers from the Education and Public Relations office of the European Southern Observatory. If you'd like more information about their education projects, they can be contacted at: info@astroex.org or go to their web site www.astroex.org. For more information on educational products from the American side, go to the Hubble Deep Field Academy at: http://amazing-space.stsci.edu/hdf-top-level.html

A Taste of Real Astronomy — The ESA/ESO Astronomy Exercises

by Arntraud Bacher, Lars Lindberg Christensen

Astronomy at the Frontline of Education
In the Footsteps of Scientists
Focus on basic themes
Six booklets

Astronomy at the Frontline of Education



Astronomy is an accessible and visual science, making it ideal for educational purposes. Over the last few years the NASA[1]/ESA[2] Hubble Space Telescope and the ESO[3] telescopes at the La Silla and Paranal Observatories in Chile have presented ever deeper and more spectacular views of the Universe. However, Hubble and the ESO telescopes have not just provided stunning new images, they are also invaluable tools for astronomers. The telescopes have excellent spatial/ angular resolution (image sharpness) and allow astronomers to peer further out into the Universe than ever before and answer long-standing unsolved questions.

The analysis of such observations, while often highly sophisticated in detail, is at times sufficiently simple in principle to give secondary-level students the opportunity to repeat it for themselves.

In the Footsteps of Scientists

The "ESA/ESO Astronomy Exercise Series" has just been published, on the web and in print. These exercises allow 16-19 year old students to gain exciting hands-on experience in astronomy, making realistic calculations with data obtained by some of the world's best telescopes, Hubble and ESO's Very Large Telescope (VLT). Carefully prepared by astronomers and media experts, these exercises enable the students to measure and calculate fundamental properties like the distances to and the ages of different kinds of astronomical objects.

The application of scientific methods requires only a basic knowledge of geometry and physics. Students use ideas and techniques described in recent frontline scientific papers and are able to derive results that compare well with those obtained from the much more sophisticated analyses done by the scientists.

The language for the ESA/ESO Astronomy Exercise Series is English. There are several reasons for this choice — it is the language used most often among scientists. Good knowledge and practical experience in the use of this language is a valuable asset for all students, particularly for somewhat technical texts like these. In modern education it has been recognised that it is important to cross barriers between different subjects and to link them by using inter-disciplinary activities that develop and strengthen several different types of skills. Thus, we recommend that the English text of these exercises may also serve as exercise in the practical use of English. We are doing our best to provide versions in some of the other ESA/ESO member state languages.

All the exercises are constructed with a background text followed by a series of questions, measurements and calculations. The exercises can be used either as texts in traditional classroom format or, as the exercises are quite self-explanatory, be given to smaller groups as a part of 'project work'. The exercises are intended to be independent of each other. However, we recommend that the relevant parts of the Toolkits are worked through with the students prior to assigning the exercises, unless the content is already familiar to them.

Focus on basic themes

The first four exercises focus on measurements of distances in the Universe, one of the most basic problems in modern astrophysics.

The students apply different methods to determine the distance of astronomical objects such as the supernova SN 1987A, the spiral galaxy Messier 100, the Cat's Eye Planetary Nebula and the globular cluster Messier 12. With these results it is possible to make quite accurate estimates of the age of the Universe and its expansion velocity. All thiswithout the use of computers or sophisticated software.

Students can also perform 'naked-eye photometry' by measuring the brightness of stars on two VLT

images (taken through blue and green optical filters, respectively). They can then construct the basic luminosity-temperature relation (the "Hertzsprung-Russell Diagram") providing a superb way to gain insight into fundamental stellar physics.

Notes

1. National Aeronautics and Space Administration
2. European Space Agency
3. European Southern Observatory
