*Figure 1: The official group photo is taken during the break of the talk by H.-J. Röser. From left to right in the first row: M. Billères, J. Dias, M. Van den Berth, A. Shaker, B. Wolff, I. Burud, M. Scodeggio. Second row: H.-J. Röser, T. Böhm, G. Meylan, M.-P. Véron, G. Jasniewicz, C. Boisson, L. Vannier, N. Przybilla, R. Kotak, A. Gonçalves. Third row: J. Kahanpää, R. Ibata, G. Marino, P. Woudt, G. Bergond, J. Vink, P. Kervella, S. Wolf, A. Zappelli, B. Parodi, Y. Momany.*

tation, detectors, and data reduction. H.-J. Röser gave a comprehensive overview on imaging and photometry, with careful emphasis on how to avoid all classical pitfalls during observations as well as data reduction. D. Baade presented an equally useful presentation on low- and high-resolution spectroscopy. M. Dennefeld described optical and IR detectors, emphasising their physical processes and limitations, with present and future VLT instruments in perspective. P. Magain presented in a very clear way the subtilities and difficulties of deconvolution techniques applied to the process of data reduction. F. Rigaut gave a stimulating presentation of active and adaptive optics, the former technique being a must for the VLT meniscus monolithic 8.2-m mirrors, the later allowing to forecast major technological improvements in the near future.

On the final day, each group of students presented a summary of their results. Although the analysis techniques had, for the most part, just been learned, all groups presented interesting and in some cases potentially publishable results. This is no small achievement considering that most of them were entirely new to the scientific subject, the observing process, and the data analysis.

# Sea & Space – A Successful Educational Project for Europe's Secondary Schools

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## 1. Background

There are many links between the Sea and the Space surrounding us. Indeed, Space itself is often likened with a new and uncharted Ocean on which we now continue the great voyages of discovery of the past. Space-based satellites allow us to study the processes in the Earth's oceans in unprecedented detail and at the same time to verify complex principles in fundamental sciences like physics, chemistry and mathematics. Space is also our tenuous link to the distant places from where the ingredients of life first came to our planet, and the ocean is where they began the incredible evolutionary processes of which we ourselves are a product.

With the goal to explain and illustrate some of these connections, an international educational programme entitled "Sea & Space" was set up under the auspices of the 1998 European Week for Scientific and Technological Culture. It was also linked directly to EXPO '98, the World Exposition in Lisbon that focuses on the Oceans. The programme was primarily directed towards Europe's secondary school students and their teachers. However, it was based on widely accessible communication links and was open for other interested persons and groups.

This was the fifth time since 1993 that ESO participated in this Week that is coordinated and supported by the European Commission. "Sea & Space" was a collaborative project between the European Space Agency (ESA), the European Southern Observatory (ESO), the European Association for Astronomy Education (EAAE), the German National Centre for Information Technology (GMD) and the Norwegian Space Centre. It drew upon the complementary scientific-technological and educational experience as well as organisational set-up of the partner organisations, including a great diversity of hard- and software and associated communication techniques. The programme was overseen by an International Steering Committee (ISC) consisting of representatives of each of the organisations, together with EAAE National Committees and other partners at the national level. Full information may be found on the web, e.g. at URL: http://www.eso.org/seaspace.

## 2. Contents

"Sea & Space" consisted of five major sub-programmes, three of which were heavily based on the use the World-Wide Web:

### *2.1 Remote Sensing of Europe's Coastal Environment*

Observations were made with the ESA Earth Resources Satellite (ERS) of coastal and other selected areas, some of these at the specific request by the participants. The data were suitably prepared and made available to the participants via the WWW, to enable the recipients to

perform various computer-based exercises on the satellite data with special software packages and complement them with field measurements.

### *2.2 Navigation*

With the help of carefully developed guidelines, the participants were able to determine their geographical positions in three different ways: by use of a variety of astronomical measurements using the Sun and the stars, with the Global Positioning System (GPS) and using satellite imagery. The participants could compare the results from the different methods and their uncertainties, providing them with fundamental insights into geodetic techniques and related areas, including technical and cultural aspects of important historical navigational feats.

### *2.3 "Oceans of Water"*

There is water everywhere, not only on Earth, but also in space. Recent research has shown water to be present in much larger quantities than thought before, on the Moon, in the outer solar system, in the atmospheres of giant stars and in the interstellar clouds of dust and gas. This part of the "Sea & Space" programme was aimed at explaining the ubiquitous nature of this molecule that is so crucial for life on Earth. It gave the opportunity to introduce various interdisciplinary aspects (physics, chemistry, mathematics, geography, biology, astronomy) and to explain where there is water and how this precious resource influences the habitability of our planet, as compared to its sister planets, Mars and Venus.

### *2.4 The Contests*

National competitions were launched among school pupils in the member countries of the European Union and of the partner organisations. Younger pupils (aged 10–13) made drawings/posters, while older participants (aged 14–18) prepared "Newspapers", working in small groups with their teacher(s). Typical subjects were "historical case stories from ocean navigation", "current methods of navigation on land and sea", as well as "reports on earth-observations by satellite". Informed speculations on parallels between the future exploration of space with new facilities, by remote sensing (e.g. ESO VLT) and *in situ* (e.g. ESA solar system missions), and the earlier ocean voyages, also found their way into the newspapers.


*The competition was announced on the Web, and brochures were distributed to secondary schools in 16 European countries.*

*The winning posters by the 10–13-year-old children were put on display at the Gil Pavillon by the winning teams from the newspaper contest.*

### *2.5 The Lisbon Event*

The "Lisbon event" marked the final activity of the "Sea & Space" programme. It was organised in close collaboration with the other programmes within the 1998 European Week for Scientific and

Technological Culture, with the national first-prize winners of the Newspaper contest as participants. The event included presentations of the winning contributions as well as encounters with astrophysicists, ESA astronauts and others.

The presentations by the students took place at the Calouste Gulbenkian Planetarium. These presentations also formed the basis for awarding a "Super Prize" (a visit to the Kourou Space Centre and the VLT Observatory at Paranal) to the best team. This award went to a team from Blackrock College in Dublin, Ireland.

Finally, on Sunday 30 August, as part of the Sea & Space programme, a public presentation and discussion took place at the Sony Plaza of EXPO '98 with participation by scientists from ESA, ESO, the Max Planck Institute for Radioastronomy, a high-ranking representative from the European Commission and the Portuguese government, represented by the Minister for Science and Technology, Prof. J. M. Gago.

*Prof. J.M. Gago, the Portuguese Minister for Science and Technology, in a lively discussion with the young Sea & Space participants at the Sony Plaza of EXPO '98.*

### 3. Outlook

Sea & Space was the first major web event that included Earth observations, and the contacts between ESO's sister organisation, ESA, and EAAE constitute an important step in introducing Europe's space programme and knowledge about remote sensing techniques to the schools. At the same time, Sea & Space was conceived with the purpose of conveying a clear message about our own position in space, i.e. an important aspect of modern scientific culture.

For the schools, the Sea and Space contests – in addition to being very useful for the development of interdisciplinary awareness – were also considered as vehicle for promoting the standing of the individual learning centres. It is apparent that this consideration is gaining increasing importance, as an element of competition finds its way into the European school system.

For ESO, the Sea & Space programme marked a natural continuation of the many-sided educational activities that – with the support by the European Commission – began at this organisation in 1993. They soon included a crucial 1994 conference that led to the establishment of EAAE, the European Association for Astronomy Education. Since then, many teachers engaged in astronomy education at various levels all over Europe have joined EAAE.

In addition to learning about new teaching ideas, methods and materials, they have also become much more aware of current astronomical activities, including many of those at ESO. New images and discoveries and frequent information about a wide spectrum of astronomical news, also from other sources, are rapidly disseminated among EAAE members who welcome this new service and regard them as useful educational tools.

The ESO-backed educational activities during the recent years are clearly seen as positive initiatives, not only by the participating schools, but also by the media and the national education authorities.

One of the important tasks of the ESO EPR Department in the near future will be to bring ESO's VLT and the results that will come from this wonderful facility closer to educators and students. This may happen in different ways and requires input from professional astronomers and teachers as well as multi-media experts. A close collaboration between EAAE and ESO is now being set up to start this programme.

# ANNOUNCEMENTS

## List of New ESO Publications

### Scientific Preprints

(June–August 1998)

1274. F. Comerón and P. Claes: Compact HII Regions in the Large Magellanic Cloud Observed by ISO. *A&A*.
1275. A.R. Tieftrunk, S.T. Megeath, T.L. Wilson and J.T. Rayner: A Survey for Dense Cores and Young Stellar Clusters in the W3 Giant Molecular Cloud. *A&A*.
1276. L. Pasquini and T. Belloni: Optical Identification of ROSAT Sources in M67: Activity in an Old Cluster. *A&A*.
1277. S. Savaglio: The Metal Absorption Systems of the Hubble Deep Field South QSO.
1278. G.F. Lewis and R.A. Ibata: Quasar Image Shifts Due to Gravitational Microlensing. *Astrophysical Journal*.
1279. R.A. Ibata and G.F. Lewis: Galactic Indigestion: Numerical Simulations of the Milky Way's Closest Neighbour. *Astrophysical Journal*.
1280. M.J. Irwin, R.A. Ibata, G.F. Lewis and E.J. Totten: APM 08279+5255: An Ultraluminous BAL Quasar at a Redshift $z$ = 3.87. *Astrophysical Journal*.
1281. R.A. Ibata and A.O. Razoumov: Archer of the Galactic Disk? The Effect on the Outer HI Disk of the Milky Way of Collisional Encounters with the Sagittarius Dwarf Galaxy. *A&A*.
1282. R.A. Ibata, H.B. Richer, G.G. Fahlman, M. Bolte, H.E. Bond, J.E. Hesser, C. Pryor and P.E. Stetson: HST Photometry of the Globular Cluster M4. *Astrophysical Journal* Suppl.
1283. P.J. Grosbøl and P.A. Patsis: Stellar Disks of Optically Floculent and Grand Design Spirals. Decoupling of Stellar and Gaseous Disks.*A&A*.
1284. J. Sollerman, B. Leibundgut and J. Spyromilio: SN 1996N – A Type Ib Supernova at Late Phases. *A&A*.
1285. M. Della Valle, M. Kissler-Patig, J. Danziger and J. Storm: Globular Cluster Calibration of the Peak Brightness of the Type Ia Supernova 1992A and the Value of $H_0$. *M.N.R.A.S.*
1286. E.M. Corsini, A. Pizzella, J.G. Funes, S.J., J.C. Vega Beltrán and F. Bertola: The Circumstellar Ring of Ionized Gas in NGC 3593. *A&A*.
1287. F. Comerón and L. Kaper: Numerical Simulations of Wind Bow Shocks Produced by Runaway OB Stars. *A&A*.