

# The European Astrophysics Doctoral Network

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## 1. What is the EADN?

In 1986, a group of university astrophysics institutes in eleven Western European countries established a federation known as the European Astrophysics Doctoral Network (EADN). The aims of the EADN, then and now, are to stimulate the mobility of postgraduate students in astrophysics within Europe, and to organize pre-doctoral astrophysics schools for graduate students at the beginning of their PhD research. The network has by now expanded to include about 30 institutes in 17 Western European countries, and ways are being actively sought for expanding the EADN even further to include Eastern and Central Europe. The coordinators have been Prof. Jean Heyvaerts (France) until 1992, Prof. Loukas Vlahos (Greece) 1992-1993 and myself since 1993. The network is financially supported by the European Union "ERASMUS" and the "Human Capital & Mobility" programmes as well as by national funds.

## 2. The Student Mobility Scheme

The Student Mobility Scheme has been designed to encourage postgraduate, or in some cases senior graduate, students to undertake part of their doctoral or diploma thesis research at an institute which is part of the network. It offers ERASMUS funded grants intended to cover student travel expenses and extra expenses encountered by the student caused by living away from their home institute. The grants are not full grants since it is expected that the student can retain the home grant while at the partner institute. The duration of the visit is usually anywhere between 3 and 12 months and must be preceded by contacts between the student's regular thesis advisor and the network partner advisor. These kinds of interactions often lead to further collaboration and the programme also includes the possibility of financial travel support for teaching staff in connection with the student's thesis defence. A full list of current partners is available on the World Wide Web at the URL "<http://www.cp.dias.ie/astro/eadn>".

## 3. The Schools Programme

The schools are essentially intensive theoretical and practical training courses targeted at young astrophysics graduates normally in their second or third year of their doctoral studies. The EADN schools aim to inform postgraduate students in the most modern aspects of astrophysics and to offer them the opportunity of contact with some of the most advanced European researchers in their field. Major attention is paid by the organizers and lecturers to the specialized training aspect of the meetings. Activities designed to personally involve the students are arranged including, for example, discussion groups, talks by students on their thesis research topics, poster sessions and practical exercises in numerical computation. In essence, therefore, EADN Schools follow closely the format of a typical school with intensive courses by experts, contributed papers (both oral and poster from the students) and published proceedings. The content of the courses by

the European experts, though advanced, are directed at a broad astrophysics audience. They should, in general, still be understandable by those who are relative newcomers to the themes of the school. This aspect is unfortunately lost in most “professional” conferences and summer schools. At the same time the subject matter of the schools are of a sufficiently specialized nature that *they are often best thought of in a European, rather than a national basis in order to provide the necessary “critical mass”*. Thus the EADN feels it fills an important niche in the training of senior astrophysics Pads and at the same time increasing their awareness of the opportunities being offered in Europe.

To date eight such schools have been organized by the EADN (listed in the Appendix) and the ninth school on the themes of “Stellar Atmospheres: Theory and Observation” is currently being planned for September 1996 in Brussels. The schools themselves are normally of two weeks duration and draw on the talents of around eight European experts to deliver the intensive courses. Typically they are attended by 40-60 European students.

As a rule, each school proposes two closely related themes one being astrophysical and the other more methodological, i.e. in the field of technology or in numerical studies. For example, in Berlin (1992, see Appendix) the themes were “Star Formation” and “Techniques in millimeter and Infrared Astronomy”. Here the relationship between the two themes is that technological breakthroughs in millimeter and infrared astronomy have contributed enormously to our understanding of how stars like our Sun form. In the recently organized school in Leiden on “The Structure of the Universe” these ‘two streams’ of theory and observations again appear, with detailed treatment of the ways in which the work is actually done. Students were given the opportunity to do actual experiments with the observational data. This requires access to local computers and carefully prepared small-scale experiments. We thus aim for a ‘hands-on and brains-on’ approach, in which the ‘streams’ do not run sequentially but in parallel.

The format of the EADN schools are intensive with two weeks of lectures, 5 days per week, for 4 hours per day. These 40 hours of lectures are usually given by 8 lecturers so that each individual’s contribution on a particular sub-topic consists typically of around 5 lectures. The lecturers normally do not stay for the entire two weeks of the school but typically for 3 or 4 days. During this time as much interaction with the postgraduate students as possible is encouraged. Such a scheme allows time for discussions between lecturers and students and for practical exercises in association with the methodological lectures. In addition each postgraduate is asked to give a short paper on his or her personal research subject irrespective of whether he or she has obtained results, to the other students and lecturers. Facilities for the presentation of poster papers are also made available at the meetings and such contributions are actively encouraged.

The proceedings of the EADN Summer Schools *are published* in the “Lecture Notes in Physics” series by Springer-Verlag. Free copies of the book are distributed to participating students and lecturers and the EADN series has now grown to a size where it is a very useful source of teaching material to astrophysics students (see Appendix A).

#### 4. The European dimension

A clear outcome of our summer schools is that they create amongst the students the feeling that they belong to the wider European scientific community. The network feels that it is important that the European dimension be stressed and implanted at an early stage and this, we think, is successfully done by the EADN both through its schools and its student mobility scheme. Obviously through such schemes we foster movement of astrophysicists within Europe, and we also make them aware of the large ground based and space borne facilities available either within the framework of organizations like ESA



FIGURE 1. The somewhat serious side of an EADN School: Donald Lynden-Bell from the Institute of Astronomy in Cambridge lecturing at the Thessaloniki School on Galactic Dynamics and N-Body Simulation Techniques.

(European Space Agency) and ESO (European Southern Observatory) or in individual facilities such as IRAM, MERLIN, the La Palma Observatory in the Canary Islands, et cetera.

## 5. The future

With the adoption by the European Union of the SOCRATES programme to replace ERASMUS, the operation of the EADN has entered a period of uncertainty. The emphasis in the past under ERASMUS was on large networks administered by a principal coordinator and the principal coordinator was usually an academic. SOCRATES by contrast is much more clearly aimed at encouraging bilateral exchanges between universities and the administration is taken care of by the university administration through an institutional contract. There has been a lot of heated debate as to whether the latter approach is the best one but in any event time will tell. The new SOCRATES programmes will commence in the '97/'98 academic year and efforts are currently under way to maintain the spirit of the

EADN under these new arrangements.

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**Appendix A. List of EADN Schools and Book Titles.**

Evolution of Galaxies and Astronomical Observations, Les Houches, eds. I. Appenzeller, H.J. Habing, P. Léna, Springer-Verlag, Lecture Notes in Physics, Vol. 333

Late Stages of Stellar Evolution and Computational Methods in Astrophysical Hydrodynamics, Ponte de Lima, ed. C.B. de Loore, Springer-Verlag, Lecture Notes in Physics, Vol. 373

Central Activity in Galaxies and Observational Data to Astrophysical Diagnostics, Dublin, eds. A. Sandqvist, T.P. Ray, Springer-Verlag, Lecture Notes in Physics, Vol. 413

Galactic High- Energy Astrophysics: High Accuracy Timing and Positional Astronomy, Graz, eds. J. van Paradijs, H.M. Maitzen, Springer-Verlag, Lecture Notes in Physics, Vol. 418

Star Formation and Techniques in Infrared and mm-wave Astronomy, Berlin, eds. T.P. Ray, S.V.W. Beckwith, Springer-Verlag, Lecture Notes in Physics, Vol. 431

Galactic Dynamics and N- Body Simulation Techniques, Thessaloniki, eds. G. Contopoulos, N.K. Spyrou, L. Vlahos, Springer-Verlag, Lecture Notes in Physics, Vol. 433

Basic Plasma Processes and Diagnostics of Astrophysical Plasmas, Florence, eds. C. Chiuderi, G. Einaudi, Springer-Verlag, Lecture Notes in Physics, Vol. 468

The Structure of the Universe, Leiden, ed. V. Icke, Springer- Verlag, Lecture Notes in Physics, in preparation.