STUDENTS AT ESO/SANTIAGO: THE PERIOD 1999-2004

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IN PARALLEL with the start of VLT operations in the last quarter of 1998, the development of ESO's research facilities in Santiago has provided increased opportunities for students, from ESO member states in particular, to be trained in Chile under different ESO programmes.

In this short review, I will essentially discuss students undergoing short-term training and students preparing a PhD (ESO studentship programme) at ESO/Santiago. I will show how the number of students trained at ESO/Santiago has more than doubled since 1999 and discuss the impact of the student training programs on the visibility and attractiveness of ESO/Chile.

This analysis is restricted to students in physics/astrophysics, as the training of student-engineers and student-technicians, mostly performed at (and for) the observatories (LaSilla, Paranal, APEX, ALMA) has not been taken into account. Finally, one should also mention that student training at ESO/Santiago is organized in a way similar to student training at ESO/Garching and all under the responsibility of the Office for Science.

STUDENTS ON SHORT-TERM TRAINING

This term corresponds in fact to a variety of training, with the common characteristic of a stay at ESO/Santiago which is less than 6 months. Included under this term is research training at the level of Licenciatura or Magistere (2 years before the start of a PhD), of the MSc, DEA/DESS or Laurea graduation (1 year before the start of a PhD), but also some training performed in the course of PhD preparation, for example if the student's PhD supervisor is collaborating with an ESO/Chile staff member. Therefore, the funding for the training may come from different sources within or outside ESO, such as the visitors' programme or the students' home institute (or a mixture). As such, training is in relation with university schedules, mostly taking place during the period January-August.

Since 1999, the number of students at ESO/Santiago has evolved dramatically, demonstrating increasing interest. We hosted in 1999: 5 students; in 2000: 7 students; in 2001: 18 students; in 2002: 12 students; in 2003: 10 students, and in 2004: 13 students. Over 6 years, 65 students have been trained at ESO/Santiago, which gives a mean of around 11 per year.

Analyzing the university affiliations of these 65 students, we observe that 84% of the students are registered at a university in an ESO-member state. Breaking down this figure per country, we get: 37% in France, 18.5% in Italy, 9.5% in Germany, 9.5% in the Nordic countries and 6.5% in the UK. This distribution is obviously related to the university's requirements: whenever research training is mandatory during the university course, the students apply in greater number: this is the case for France, while it does not seem to be as stringent for Germany, Italy or the UK.

Regarding their academic level, about half of the trainees were advanced students (one year before PhD or during PhD).

Regarding the topics of the training, they reflect the scientific interests of the ESO/Chile staff at a given time, and therefore have been changing with time. Over the 6 year period, 26% of the short-term training was in planetary science (including the Solar System), 11% about stellar and ISM studies, 34% in the field of galaxies and active galactic nuclei, 14% in cosmology and 9% in relation with instrumentation and data reduction techniques.

The training output is frequently a report which the student has to write and defend at her/his university and which is taken into account for the evaluation and award of the degree. We observe that a good proportion of the students have taken their degree at a ranking within the top quartile, demonstrating that ESO/Santiago attracts excellent students. Moreover, the scientific results obtained during the training are often included in a poster presentation or a refereed paper published with the ESO/Chile supervisor and collaborators.

A large fraction of the short-term students seem to have appreciated their training. As much as possible, they were given the opportunity to visit one of ESO's observatories in Chile. For all of them, it has been the occasion of testing their motivation for research and of discovering the reality of astronomical observations and analysis. Many have confirmed their original choices, and a few changed their mind and decided to move to other types of activities. This is exactly the goal of training: in all cases, whether research interests have been consolidated or not, the training has been useful and has contributed to reducing the gap which exists sometimes between dreams and reality. Some of the students on short-term training later prepared their PhD at ESO/Santiago (see below).

In practice, the conditions for a successful training are: a strong motivation, curiosity, adaptability to a new environment, ability to work with some independence and to be pro-active in the interaction (since the ESO/Chile staff spend part of their time at the observatories and cannot provide a close, day-to-day supervision). Therefore, advanced students are better suited for short-term training at ESO/Santiago. It is also recommended to start contacts with potential ESO/Chile supervisors very early (in November/ December) so that a good training-project can be prepared and its funding put in place.

Information about short-term student training at ESO/Santiago can be found in the webpage: www.sc.eso.org/santiago/science (check the ESO/Chile Scientific Visitors Programme).

STUDENTS PREPARING A PHD IN CO-SUPERVISION

This is the ESO studentship programme, of which a detailed description can be found on the ESO webpage (www.eso.org/gen-fac/adm/pers/vacant/). In brief, ESO provides a two year studentship for students preparing their PhD in co-supervision. The student has to be registered in the university where the PhD will be defended, and has two co-supervisors: one at ESO/Santiago (or ESO/Garching if the student is hosted at ESO/Garching) and one in her/his home university (preferably located in one of the ESO member states, although this is not mandatory). The third year of PhD preparation should normally be funded by the university or laboratory of the co-supervisor. Applications for this programme can be submitted once a year, by mid-June. Currently, about 20 PhD students are under this ESO programme, half at ESO/Garching and half at ESO/Santiago. There must be an excellent coordination between the two co-supervisors, for a good definition of the PhD project and a smooth development of the PhD.

Regarding the PhDs prepared at ESO/Santiago, again, there has been an increase in the number of studentship offered since 1999, by almost a factor two. In 1999, there were 6 PhD students at various stages of their PhD, while as of September 2004 we have 10 and another one arriving within a few months. Of course this number fluctuates slightly as the students'

works advance, but a figure of 10 is the base.

From 1999 to 2004, there were a total of 26 PhD students at ESO/Santiago: 10 have successfully defended their PhD, and all but one are now postdocs in various observatories or laboratories; 6 are planning to defend their PhD at the end of 2004 or early 2005; 2 will present their PhD around the end of 2005; and 6 others are just finishing their first year and therefore will present their PhD at the end of 2006, while 2 are just starting.

For this sample of 26 PhD students, 90% of the PhD affiliations are at universities in ESO member-states (13 in France, 3 in Italy, 3 in Germany, 2 in Belgium, 1 in Sweden and 1 in the UK). The distribution per subject is as follows: 7 PhDs are in the field of planetary science, 7 in the field of galaxies and active galactic nuclei, 7 in cosmology, 3 in stellar physics and 2 in relation with instrumentation or data reduction techniques.

Contrary to a classical university environment, PhD students at ESO/Santiago do not have many opportunities to attending dedicated courses on a given subject. We tried to compensate for this lack of formal course work in several ways: most of the international astronomical workshops organized in Chile start with a tutorial by a prominent speaker specifically targeted for students, several schools and topical meetings have been organized and senior visitors who can bring in their academic experience have been invited. As well, Chilean universities offer a variety of excellent astronomy courses which PhD students can attend if deemed necessary. The student's non-ESO co-supervisor is also encouraged to come and spend some time at ESO/Santiago to appreciate the scientific environment of the student and make the necessary adjustments. In general, this works quite well.

As a specific feature, PhD students at ESO/Santiago have the possibility to take part in an observatory project (La Silla or Paranal) which puts them in close contact with telescopes, instrumentation and observing procedures. Most students enjoy the observatory projects during which they gain observational expertise.

Concluding remarks

Over the past 6 years, students' short-term training and PhD preparations at ESO/Santiago have become an important activity and played a significant role in advertising ESO facilities. ESO/Chile has increased its attractiveness, in particular at the postdoctoral level (as shown by a steady growth in the number and quality of fellowship applications for ESO/Chile). The short-term training helps students to test their motivation for research. Short-term training and PhD preparations contribute to strengthening links between ESO/Chile staff and astronomers in the ESO member states. They also stimulate in an excellent manner the research activities of ESO/Chile staff and give ESO/Santiago its multi-cultural flavour and its youth, our future!

Report on the joint MPA/MPE/ESO/USM workshop on

Growing Black Holes: Accretion in a Cosmological Context

Andrea Merloni and Sergei Nayakshin (MPA-Garching)

The goal of the meeting was to draw some of the best astronomy researchers from every part of the world to showcase the most recent scientific successes of the Garching/Munich astronomy community, and to also allow the local researchers to learn from the rest of the world. The Conference was held at the Institute for Plasma Physics in Garching, Germany on June 21–25, 2004.

Supermassive black holes (SMBHs) are among the most spectacular objects in the Universe, that shed light on fundamental physical phenomena occurring in their immediate vicinity, such as accretion of gas and strong gravity effects. Historically, theories of accretion have been developed and refined based on observational studies of individual SMBHs that are believed to be powering quasars, first discovered more than 40 years ago. This research stood somewhat separate from cosmology that deals primarily with the formation and evolution of galaxies. However, in recent years, it has been established that black holes lie in the centres of practically all galaxies, and significant links between cosmic structure formation and evolution and supermassive black holes have been demonstrated. Nowadays, SMBH are not just interesting laboratories of exotic physics, but have direct impact on the evolution of the Universe as we see it: they are an important ingredient of cosmological models.

The meeting brought together about 170 scientists from the extra-galactic astronomy, cosmology and accretion physics communities to discuss the implications of the connection between supermassive black hole growth and galaxy formation. For the first time in a meeting of this series, a video-conference connection was established between the Conference hall and both MPA and ESO, to allow the local students to listen to some of the most interesting talks.

We started on Monday with a welcome address from Rashid Sunyaev (MPA), and continued with a session dedicated to the observations of supermassive black holes in the local Universe. Topical reviews were given by Ralf Bender (MPE/USM), who discussed the fundamental correlations observed between SMBHs and their host galactic bulges, and Guineviere Kauffmann (MPA), who presented the analysis of the impressive amount of data on local AGN gathered by the Sloan Digital Sky Survey (SDSS). They both pointed out the important fact that only relatively small mass black holes are actively accreting (and growing) today, while many hints suggest that the biggest black holes in the Universe were formed at very high redshift.

The second session was devoted to the observations of SMBH in the distant universe. Xiaohui Fan (Arizona) and Niel Brand (Penn State) presented the optical and X-ray views, respectively, of the most distant QSOs known. They have vividly illustrated the great progress being made in this area thanks to the SDSS and the Chandra and XMM-Newton X-ray satellites. The first day ended with a few talks, including a review by Bernhard Brandl (Leiden), on the first scientific results in the field from the Spitzer Space Telescope, launched into space in August 2003.

One of the most important open questions in the field is whether black holes were seeds or by-products of galaxy formation. The second day of the meeting was entirely devoted to the theory of black hole formation and growth in the early Universe. The morning session started with a review by Martin Rees (Cambridge) on the physical process through which the first black holes might have formed, while Piero Madau (U of California Observatories) and Abraham Loeb (Harvard) discussed in more detail what predictions can be made by incorporating the physics and dynamics of growing black holes into standard Cold Dark Matter Cosmological models. Also, state-of-the-art cosmological numerical simulations were presented at the meeting: Volker Bromm (Harvard) concentrated on simulating the process of formation of the first stars and black holes, while Volker Springel and Tiziana Di Matteo (MPA) showed spectacular simulations of evolving and interacting galaxies with supermassive black holes in their centres. Finally, Zoltan Haiman (Columbia University) dis-