

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 envi-

ronment, 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

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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-

cussed the role of accreting black holes in the re-ionization of the Universe.

The day, started under a chilly rain, ended with a sunny 'Beer and Brez'n' party in the MPE/MPA garden. Faithful to the Bavarian spirit, the organizers provided the guests with more than 250 liters of locally brewed beer!

The following morning the centre of attention was the centre of our own galaxy: the SMBH also known as Sgr A*. Reinhard Genzel (MPA), Mark Morris (UCLA) and Fred Baganoff (MIT) presented the amazing new data gathered in the last few years with the biggest telescopes on earth (VLT, Keck) as well as in space (Chandra). Thanks to these efforts, the case for a black hole in the Galactic Centre appears now to be iron-clad. Moreover, future theoretical interpretation of the data will likely significantly improve our understanding of the black hole growth mechanisms and the associated star formation very close to the black hole.

Another important question was discussed on Wednesday afternoon: the role of galaxy mergers, accretion and stellar captures for the overall black hole growth. David Merritt (Rochester) reviewed the various mechanisms by which SMBHs induce observable changes in the distribution of luminous and dark matter at the centres of galaxies. Later in the afternoon, Marek Abramowicz (Chalmers University) sug-

gested that there are no theoretical limits on the rate at which the gas can be swallowed by a black hole.

On Thursday morning a new window of the gravito-electro-magnetic spectrum was opened to the study of SMBHs: gravitational waves. Sterl Phinney (Caltech) gave a comprehensive overview of the exciting prospects and challenges that lie ahead for gravitational wave astronomy. Bernard Schutz (MPI-Potsdam) illustrated the breathtakingly complex numerical simulations of BH-BH merger events, a possible target of the upcoming Laser Interferometer Space Antenna (LISA). And an overview of the technical aspects of the LISA mission was given by Karsten Danzmann (AEI Hannover).

How important is the feedback from supermassive black holes in structure formation? This fundamental question was deeply investigated by many of the speakers of Thursday afternoon's session. Andrew King (Leicester) advocated the importance of powerful outflows from rapidly accreting black holes in establishing the observed links between SMBHs and host galaxies. Mitchell Begelman (Colorado) showed how AGN feedback can solve the mystery of the lack of strong cooling flows in the centres of many clusters of galaxies, and William Forman (Harvard) presented many new Chandra observations of hot gas in galaxy clusters.

A chance to relax during this intense conference was the conference dinner at the Augustiner Groggasttaetten in central Munich. The local organizing committee, Jorge Cuadra, Andrea Merloni, Emmi Meyer, Sergei Nayakshin and Rashid Sunyaev, all MPA, Thibaut Paumard (MPE) and Gijs Verdoes Kleijn (ESO), presented some gifts to the MPA secretaries (Maria Depner, Gabi Kratschmann, Kate O'Shea and Cornelia Rickl), whose help throughout the organization of the conference and during it was a real blessing to the LOC.

On the last day of the meeting, the classical problem of what the X-ray Background tells us about AGN activity and obscuration, both at low and at high redshifts, was revisited in the light of the most recent results from deep X-ray surveys by Andy Fabian (Cambridge) and Guenther Hasinger (MPE), and from the multi-waveband GOODS survey by Meg Urry (Yale University). The meeting was closed in an optimistic and somewhat humorous way by the 'Black Hole Manifesto' of Roger Blandford (Caltech), in which some of the most interesting developments from the meeting were summarized.

Those interested in more details of the meeting are invited to visit <http://www.MPA-Garching.MPG.DE/~bh-grow/>. Conference proceedings are to be published by Springer Verlag as a part of the "ESO Astrophysics Symposia" series.

Report on a brainstorming meeting about the

ALMA INTERDISCIPLINARY TEACHING PROJECT

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RECENT large-scale surveys have documented a widespread lack of interest in science and technology among Europe's young people. This development is highly worrying as it may lead to a lack of qualified scientists and teachers and may ultimately have dramatic demographic consequences on this continent. Various reasons for this situation have been identified and it is generally acknowledged that teaching quality at the primary and secondary levels plays a crucial role in this context. Means and methods to remedy this undesirable situation are being looked into in many countries and the European Commission has issued a strong plea for the creation of new educational initiatives, in particular broad and general ones that are easily adaptable to national curricula.

Having conducted educational programmes at the European level since 1993, the Education and Public Relations Department (EPR) of the European Southern Observatory has recently embarked upon

another ambitious teaching project, this time in connection with the ongoing, intercontinental ALMA programme that aims at the installation of a unique astrophysical research facility consisting of 64 12-m radio antennas at 5000m altitude in the Chilean Atacama desert by 2011. The related front-line science and technology, as well the unusual site, clearly have a great potential for interdisciplinary education.

A first presentation of ideas for an ALMA educational project took place during the large-scale "Physics on Stage 3" educational meeting/fair at ESA/ESTEC in Noordwijk (The Netherlands) in November 2003. For this, Bernhard Mackowiak (ESO EPR) had produced a first draft text on some subjects that may be included in a future "ALMA Teachers' Cookbook". A direct outcome was the creation of a small group of expert teachers from secondary schools in several European countries, who expressed interest in contributing to the development of ALMA-related educational material for interdisciplinary teaching.

A first exchange of views with the members of this group took place in December 2003. Following the extensive and time-consuming preparations for the Venus Transit event in June 2004, the ESO EPR Department is now promoting a new international pilot educational project referred as the ALMA-Interdisciplinary Teaching Project (ALMA-ITP). The main goal is to develop and produce ALMA-related educational material at the secondary level, in particular a comprehensive ALMA Guide for Interdisciplinary Teaching. This project is fully in line with the current trend of lowering the walls between the various subjects and moving towards more interdisciplinary teaching in Europe's secondary schools. It constitutes a contribution towards alleviation of the current educational crisis, by attempting to provide attractive opportunities for more real-life, project-oriented education to teachers and their students. At the same time, it is obvious that the material may also form a very useful basis for similar efforts in other countries involved in the