Report on

The visit of Prof R. Sunyaev to ESO/Chile and the Topical Meeting "Accretion onto Compact Objects"

Danielle Alloin, Elena Mason, Kieran O'Brien (ESO)

Over the period April 4 to April 17, we had the great pleasure of the visit of Prof. Rashid Sunyaev in Chile. This was an opportunity for him to visit some of ESO's facilities (Paranal, Santiago) as well as APEX, and also to pay a visit to the new facilities of our colleagues in La Serena (among others Magellan and Gemini).

For us, it was an opportunity to organize discussions and meetings to make use of his vast experience in the field of cosmology and high energy astrophysics.

On this occasion we held a Topical Meeting in Santiago, on April 15, on the subject of: "Accretion onto Compact Objects". About 30 participants attended the Meeting, among them many students from PUC and from ESO. Presentations ranged from theory (the theory of accretion, the evolution of low-mass X-ray binaries and millisecond pulsars controlled by gravitational radiation, the mapping of eccentric orbits in triaxial log potential, …) to observational results (echo-sounding in X-ray binaries, warped molecular gas around AGN, formation of high mass stars via accretion, …).

Theoretical problems in astrophysics are discussed only occasionally in Chile, as the astronomical activity is really dominated by observational subjects thanks to a top-level suite of telescopes. So, this provided an interesting change and gave new perspectives to the young audience at the *Topical Meeting*.

Report on the ESO Conference:

Planetary Nebulae beyond the Milky Way

J. R. Walsh and M. Rejkuba (ESO)

This three-day ESO workshop, held from 19 to 21 May 2004, devoted to extra-galactic planetary nebulae (PN), was the first full workshop on the topic. Previously there had been discussions of extra-galactic PN on the final day of the pentennial IAU Symposium on Planetary Nebulae (last held in Canberra in 2001) and a one day meeting during the IAU General Assembly in den Haag in 1994. The field has expanded considerably in the last decade with many PN now detected in Local Group galaxies, extensive surveys underway in nearby early-type galaxies and in the intergalaxy regions of galaxy clusters, together with the use of PNe as kinematic probes for galaxy potentials. There are currently many thousands of PN catalogued in external galaxies, far surpassing the approximately 1500 known in the Milky Way.

Alan Moorwood, Head of Instrumentation at ESO, in his welcome address presented a reflection from his attendance at a PN Symposium in New York in 1977. He noted that the order of the first few talks at this workshop – on surveys in the Magellanic Clouds and Local Group galaxies – was similar to that 27 years before.

However after a few talks, Alan had to agree that a lot had happened in the field since 1977! There were 16 invited reviews, 26 contributed talks and two discussion sessions over three full days, and also 13 posters, for a total of 65 participants. We present a selection from among the topics. Since all the speakers presented their talks in electronic form we collected them together after the conference and made them available linked to the items in the conference programme at http://www.eso.org/gen-fac/meetings/extgalpn04/programme.html where the reader is referred for more details.

The first extra-galactic PN were those discovered in the Magellanic Clouds and surveys are still on-going. G. Jacoby (WIYN) suggested that all the PN had been probably been discovered in the SMC, whilst many more remain to be discovered in the LMC. The cumulative plot of the number of PN against the magnitude in the [OIII] 5007Å line – known as the PN Luminosity Function (PNLF) – showed a dip at about four magnitudes below the peak for the SMC (see Figure 1). This was subsequently referred to as "Jacoby's deficit". The photographic Hα survey of the UK Schmidt Telescope in Australia is still discovering many more LMC PN. W. Reid (MacQuarie University) showed how the Hα and matched *R*-band images are differenced to reveal more than a thousand new PN candidates in the LMC, which are then followed up with multi-object fibre spectroscopy on the AAT.

In other Local Group galaxies the census of PNe conducted with the Wide Field Camera at the Isaac Newton Telescope was presented by R. Corradi (ING). Local Group dwarf galaxies were surveyed in various narrow and broad filters and the images are reduced and publically available. L. Magrini (Firenze), P. Leisy (ING) and collaborators discussed spectroscopy of some of the candidates from this survey. The census of PN in the Local Group is complementary to various Asymptotic Giant Branch (AGB) stellar surveys which were summarized by M. Groenewegen (Leuven). The AGB surveys form not only an important test of stellar evolution models, but also an excellent tool for studying chemical evolution of dwarf galaxies.

Deep surveys in nearby galaxy clusters such as Virgo and Fornax reveal the presence of true intra-cluster PN. J. Feldmeier charted the discovery of these objects. The early surveys were beset by interlopers, mostly z=3.1 Lyman-alpha galaxies; but later surveys with spectroscopic follow-up (detection of the [O III] 5007,4959Å doublet allows clear discrimination from background emission line objects) are revealing numbers of PN wandering in the spaces between galaxies. The intra-cluster PN have enormous potential for studying the number, origin, metallicity and kinematics of the intra-cluster stars. Current estimates suggest that about 15% of cluster stellar mass may reside in intra-cluster stars. Multi-fibre instruments on large telescopes show that it is feasible to measure the kinematics of the intra-cluster PN and M. Arnaboldi showed some Virgo PN spectra recently taken with FLAMES on the VLT.

The PNLF is now an established secondary distance indicator and R. Ciardullo in his review showed that the first suggestion that PN could be used as distance indicators was made in 1966. It was not until the 1990's that the PNLF was routinely applied to nearby early-type galaxies. The method works comparably well to surface brightness fluctuations with very little dependence on metallicity of the galaxy. The next challenge for the observers is to compare the PNLF constructed from Hβ and other lines with the [O III] 5007Å PNLF.

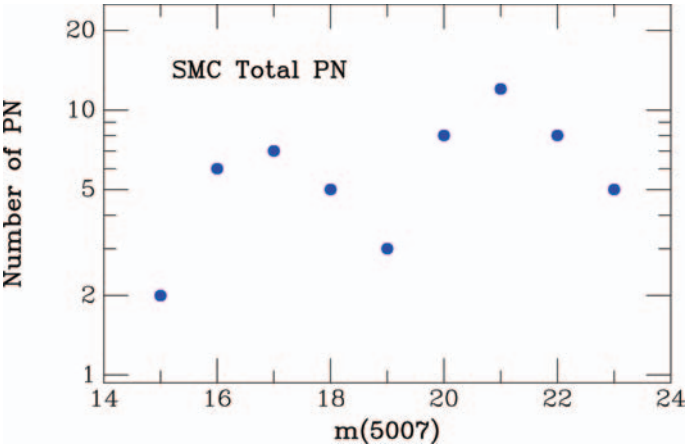

Figure 1: The Planetary Nebula Luminosity Function (PNLF) is shown for the Small Magellanic Cloud. This was presented by G. Jacoby and, given that searches for PN beyond 5007Å magnitude of 23 have failed to find further PN, it is suggested that this PNLF may be complete.

L. Girardi (Trieste) showed the advances in modelling PN evolution, but also the enormous difficulties and lack of a complete theoretical understanding of the PNLF.

R. Shaw, L. Stanghellini and E. Villaver (NOAO) presented different aspects and science from the high resolution HST survey of PN in the Magellanic Clouds. The high resolution slitless spectroscopy with STIS has enabled the study of expansion ages, connection of morphology to environment and the central star progenitor properties, such as winds and transition times, enabling tests of stellar and PN evolutionary models by placing the PN central stars in the HR diagram.

One of the aims of the conference was to draw-out the links of extra-galactic PN with other stellar indicators of galaxies and one session was devoted to the stellar connection, focussing on Asymptotic Giant Branch (AGB) stars, the progenitor stage to PN, and the stellar parameters of PN central stars. On the theoretical side, L. Willson (Iowa State) showed the complexities of mass loss on the AGB and how difficult is its parameterization.

One stumbling block to applying the classical abundance determination methods for emission line spectra is the, sometimes large, difference in the PN abundances derived from the optical recombination lines for O and Ne, for example, with those derived from the much brighter collisionally excited (forbidden) lines, such as [O II] 3727Å and [O III] 5007Å. X. Liu (Peking) showed that for some PN the discrepancy between the forbidden and recombination line abundances can reach a factor of ten. However the likely reason is that cold, metal-rich, clumps, with a small fraction of the gas mass, make a strong contribution to the recombination lines, whilst the majority of hotter and lower abundance gas produces most of the forbidden line emission. The metal-rich intrusions may be ejected by the star at late evolutionary stages or may even be planetismals within the ionized region. The bright collisionally excited lines are used to derive metal abundances and various talks discussed O abundance determination in NGC 6822, Sextans A and B and M33 extending out to NGC 5128 (3.5Mpc) and NGC 4697 (10Mpc). For the latter galaxy, R. Mendez (Univ. Hawaii) showed a comparison of the long-slit integrated stellar light metallicity with PN metallicities. These results suggest metallicities with large dispersions in the halos of ellipticals. With 8–10m class telescopes determinations of O, He, N, Ne, etc. in PN become feasible and large samples can be achieved with multi-object spectrometers, enabling studies of abundance gradients at large galactocentric radii.

The final day of the conference was almost solely devoted to dynamical studies of galaxies using the PN as probes. On account of their strong line emission (in particular the [O III] 5007Å line) and the narrowness of the lines (typically < 30 km/s), PN make ideal tracers of the gravitational potential of a galaxy to large radii, where the integrated stellar light has surface brightness too low for detection. N. Douglas (Katpeyn Laboratory) described the work done by the Planetary Nebula Spectrograph (PN.S) group. This dedicated instrument provides detections and radial velocities in a single observation. Large samples of PN have been collected with the PN.S and detailed kinematic modelling is being undertaken. A. Romanowsky (Nottingham) showed the results of modelling PN kinematics for the ellipticals so far studied (most with low X-ray luminosity) by the PN.S team. There appears to be little evidence for dark matter (*M/L* stays low even at 6 R_e – see Figure 2) as also discussed by O. Gerhard (Basel) and N. Napolitano (Kapteyn Laboratory). Ideally samples of about 1000 PN are required per galaxy for detailed modelling of the components of the potential. For M31, velocities for over 2700 PN have been measured with the PN.S and H. Merrrett (Nottingham) described the mapping of the various halo components, including the dwarf galaxies NGC 185 and 205. Comparison with the M31 stellar RGB kinematics was presented by A. Ferguson (MPA, Garching).

During the conference there were several "mini-workshops": one on M 31 as mentioned above and another on NGC 5128 which has over 1100 PN candidates and almost 800 confirmed. E. Peng (Rutgers University) presented extensive kinematic modelling, and studies of the AGB stars (M. Rejkuba) and abundance measurements of the PN (J. Walsh) were also discussed. There were two scheduled discussion sessions on "Observational Challenges" and "Future Challenges" at the end of the second and third days respectively.

With so many PN now known in galaxies beyond the Milky Way some standardization of the nomenclature is desperately required. This topic formed part of the first discussion session and was in fact triggered by an enquiry from a German amateur astronomer.

The meeting concluded with a conference summary by H. Ford (Johns Hopkins). He very bravely commented on every talk, with collages from the presentations and digital photos of the speakers. Many people contributed to the lively meeting: the SOC and in particular Letizia Stanghellini who co-chaired; Nausicaa Delmotte helped with the web pages. The smooth running of the conference organization was almost entirely due to Christina Stoffer, with Britt Sjoeberg helping out on the public holiday.

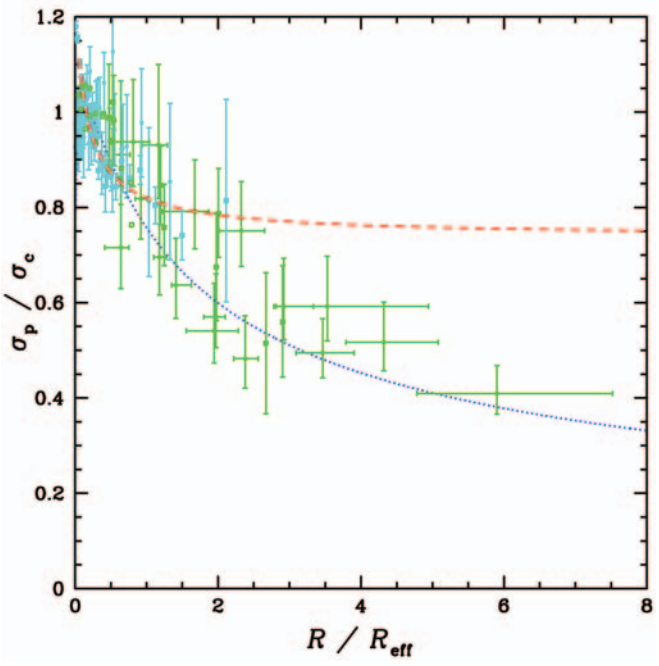

Figure 2: The observed velocity dispersion, scaled to that at the centre, derived from the PN is shown as a function of effective radius for four early type galaxies (NGC 821, 3379, 4494 and 4697) from the presentation of A. Romanowsky. The horizontal dashed line (red) is the result of a model based on an isotropic isothermal halo and the dotted blue line an isotropic constant *M/L* Hernquist model. The absence of increasing *M/L* suggests that any dark-matter halo must make a minor contribution in these galaxies.

Fellows at ESO

Thomas Dall

Since July 2002 I have been a Fellow at ESO Chile with duties at the La Silla Observatory. It is no coincidence that I asked to be assigned to La Silla: as a PhD student I had a studentship at the Nordic Optical Telescope on the island of La Palma, and there I experienced observatory work first hand, being granted responsibility as Support Astronomer and got involved in all aspects of the observatory work. I was getting my hands dirty – and getting an appetite for more.

On La Silla I find myself in a similar, although bigger, environment. The "hands-on" experience is one of the biggest assets of working at La Silla and cannot be underestimated. I learn a lot all the time, both scientifically from interacting with the visiting astronomers and from a technical point of view by working with the rest of the staff, and by getting ever more involved in different projects. Since April 2003 I have been the Instrument Scientist for the Coudé Echelle Spectrometer (CES) at the 3.6m telescope.

The subject of my PhD was pulsations in stars, mainly δ Scuti pulsators. The main complication in the understanding of these stars is that they are very fast rotators – a fact that has falsified all modelling attempts so far. Since I came to ESO my scientific work has shifted a bit. I still study stellar structure, and I am still intrigued by rotation, but my focus is now on late type active stars, studying the relationships between rotation and magnetic fields. Also symbiotic and cataclysmic variables are now part of my world. The atmosphere on La Silla and the work with the high-resolution spectrographs has fuelled my scientific work as well as given me valuable experience with a broad range of instrumentation, and I am very glad I made the decision to come to work for ESO in Chile.

Marina Rejkuba

I became a fellow at ESO Garching in October 2002 after finishing my PhD at Pontificia Universidad Católica de Chile in Santiago. For duties I opted for Paranal science operations support. This allowed me to learn a lot about all the VLT instruments, to meet visiting astronomers and gain an overview of the science done at the VLT. For that I travel to Chile four times a year and spend 56 days and nights on the mountain. The rest of the time I spend working on my scientific projects in Garching. In this way it is easy to divide the duties and science time and take the greatest advantage of both.

Life at ESO Garching is very inspiring. The large number of seminars and colloquia and many visiting astronomers ensure that no astrophysical topic passes undiscussed. It is also a place where I can always find an expert to answer my questions and many people to discuss with and share the ideas. During my PhD I studied in detail the nearby peculiar elliptical galaxy NGC 5128, also known as Centaurus A. In this galaxy we determined the recent star formation history in the halo, studied the old stellar populations and discovered many new globular clusters and more than 1000 Mira variable stars. The Mira variables are among the most luminous stars and can be used to determine not only the distance to the galaxy, but also the age distribution of its stars. Now, I still continue working on my pet object, Centaurus A, but also extend the studies of stellar populations to Magellanic Clouds, other Local Group and more distant galaxies. The central theme of these projects is the formation and evolution history of elliptical and dwarf galaxies.

In my free time I like to read books, learn new languages, or go for a bike ride or a hike in the Alps. In Germany table games are very popular and it is never a problem to gather a keen group of players and spend a pleasant evening chatting and fighting over some board or cards.

Gijsbert Verdoes

I was born and grew up in The Hague in the Netherlands. I chose to study astronomy in the university closest to the sea and my sailing dinghy: Leiden. After my undergrad studies, I moved to the Space Telescope Science Institute (STScI) in Baltimore, USA, to start the first half of my Leiden PhD under the joint supervision of Stefi Baum and Tim de Zeeuw. I studied the centres of radio galaxies using Hubble Space Telescope imaging and spectra. Today, still one of my favorite general astrophysical topics is to find out how different galaxy evolution would have been without active nuclei or, put more bluntly, do AGNs matter?

After my PhD I moved from STScI to ESO in November 2002. I knew a bit about the American 'sharp-eyed spider' and I wanted to get to know its European sharp- and large-eyed counterpart. ESO sits in many ways at the centre of the European web of observational astronomy. I also felt quite attracted to the spider's many legs: with the Fellowship system, ESO provides plenty of opportunities to gain experience and expertise not only in astrophysics, but also in fields such as instrument and software development, outreach, and organizational matters. My functional duties started in the Science Verification team for the VIMOS instrument. This also led me to start working on something new. For possible verification projects, I asked myself what the 'redshift-machine' VIMOS could do for the 'redshiftless' Universe. This eventually led, via a regular proposal, to a nice VIMOS project on globular clusters in Centaurus A and involves a few collaborators in and outside ESO. I am now carrying out functional duties in the department of Education and Public Relations, working on educational projects. It is great fun to be forced to approach astronomy from a completely different angle.

Lastly, as a flatlander by nature, a strong fringe benefit of working at ESO Germany is its proximity to beautiful mountains. Southbound trips provide for very nice recreation over the weekends all year round. To conclude: I am very happy at ESO and can see only one unimportant question. I love to see the alpine skyline on a clear day from the top floor at ESO, but.....where are the sea and my dinghy?

Paul Vreeswijk

I clearly remember the first time I saw Paranal observatory, from the plane between Santiago and Antofagasta (note that you have to be on the side of the Andes to be able to see it). Four tiny telescopes and some surrounding buildings in an ocean of reddish mountainous desert. The perspective changes completely when arriving at the telescope platform on Paranal: an impressive array of four immense telescopes, designed for the sole purpose of observing the night skies in great detail. After a dozen weeks as an ESO fellow on Paranal, the platform site is still just as amazing as the first time.

Scientifically my main interests are the

use of gamma-ray burst (GRB) afterglows as a tool to study high-redshift star-forming regions. GRBs are distant explosions, caused by the deaths of massive stars, and the resulting afterglows in the optical can be a million times brighter than their host galaxies. But only for a few minutes, as the afterglows fade away extremely rapidly. So one has to be very quick to profit from their brightness. This requires different observing strategies than commonly used in astronomy; most objects in the sky do not change their brightness in zillions of years.

To allow rapid VLT observations of GRB afterglows, an ESO working group recommended to implement the so-called Rapid-Response Mode (RRM), the automatic mode of the VLT. As a fellow and because of my scientific interests, I'm involved in the implementation of this RRM on Paranal. I find this quite exciting: as a GRB goes off and is localized on the sky by a satellite, due to the implementation of the RRM, the VLT is now able to automatically start pointing to the GRB, and observe the afterglow within minutes of the GRB explosion. And thanks to high-precision instruments such as UVES, one can obtain detailed properties of high-redshift star-forming regions. So among other superlative statements one can make about the VLT project, one can add that it is the biggest robotic telescope in the world.

Former ESO DG Adriaan Blaauw turned 90

On April 12, former ESO DG professor Adriaan Blaauw reached his 90th birthday. Adriaan, together with many friends, family members, colleagues from The Netherlands and abroad, celebrated this occasion on April 17, during an informal get-together at the 19th-century country-mansion Nienoord in Leek, near Groningen.

Well over 200 people including ESO Director General Catherine Cesarsky, shown here with her predecessor, enjoyed a most pleasant event on a warm, sunny afternoon. The event was offered to Adriaan by his present and former colleagues from the Groningen Kapteyn Institute and Leiden Observatory, who join in with colleagues worldwide in congratulating Adriaan and his wife, and wishing them well for the years to come.

ESO at the Exploring the Frontier Symposium

Ed Janssen (ESO)

The symposium, which was co-chaired by ESO's Director General, Dr. Catherine Cesarsky, took place on 18–21 May 2004 at the Max-Planck Society's Harnack-Haus in Berlin. It was dedicated to presenting and discussing the fundamental scientific questions that will be addressed by major future astrophysical facilities during the next few decades. The meeting programme featured 11 invited reviews, 27 contributed talks and 49 posters. The meeting was attended by 160 participants from 17 countries.

ESO's presence included an exhibition/information stand with emphasis on the ALMA and OWL projects. The symposium (and thereby ESO) was presented widely in the local and international media; ESO's Director General gave several interviews, including one for a major television series on groundbreaking science. This was also a topic on the prime-time TV news on the second German channel.