

Chapter 4

IN-HOUSE RESEARCH

In response to one of the findings of the International Visiting Committee report of 1998 that in-house research activities should be strengthened, PPARC agreed to fund two research fellows at ING and towards the end of 1999 both Johan Knapen and Romano Corradi joined the observatory in this capacity. These two new appointments brought the formal research allowance at ING to 3 full-time equivalent staff spread over 9 research active staff; the Head of Astronomy (UK), 2 (UK) research fellows, 5 (UK) support astronomers and 1 (NL) support astronomer.

In a further development, during 2000 the ING (Rutten/Lennon) successfully applied to the European Community to become a Marie Curie host training facility and were awarded funding for three fellowships in the area “Exploiting Adaptive Optics in Astronomy”. The first of these Marie Curie fellows, Roy Østensen, joined the ING during 2001, with the additional fellows expected in 2002.

Also in 2000, Johan Knapen was awarded a PATT rolling grant while Romano Corradi was awarded a grant from the European Commission in 2001 as partial funding for a High Level Scientific Conference to be held in 2002.

The impact of these changes on the scientific atmosphere and productivity of the observatory can be gauged from the scientific publications produced by ING astronomers. In 1999 the total number of staff publications was 40, 23 of which were published in refereed journals. During 2000 these numbers rose to 62 and 31 respectively, while in 2001 there were further rises to a total of 105 publications of which 50 were in refereed journals (see appendix F for the complete list of papers). Highlights of individuals’ research is reported on below. A welcome aspect of this activity is that ING astronomers are active participants in observing programmes which make use of ING facilities, accounting for approximately 50 nights on each telescope as principal investigators or co-investigators, competitively applied for through the normal time allocation process.



Figure 1. INT true-colour image of Sextans B galaxy from the ING-led Local Group Census Wide Field Survey programme.

As an example of the synergy such activity creates with operational activities one can point to the fact that in the second round of Wide Field Survey programmes, the ING-led proposal “The Local Group Census” (spearheaded by Nic Walton and Romano Corradi) was approved. Furthermore, our adaptive optics specialist Chris Benn has been one of the most successful applicants for time on the WHT with NAOMI.

Our astronomers have also had marked success with other non-ING facilities, some successes worth highlighting are the 85 orbits of HST time won by Lennon (64 as principal investigator), 34 HST orbits by Corradi (8 as principal investigator) and 8 HST orbits by Knapen.

Other facets of the improved scientific atmosphere at ING are the impressive seminar programme detailed in Appendix G (typically over 30 talks per year including

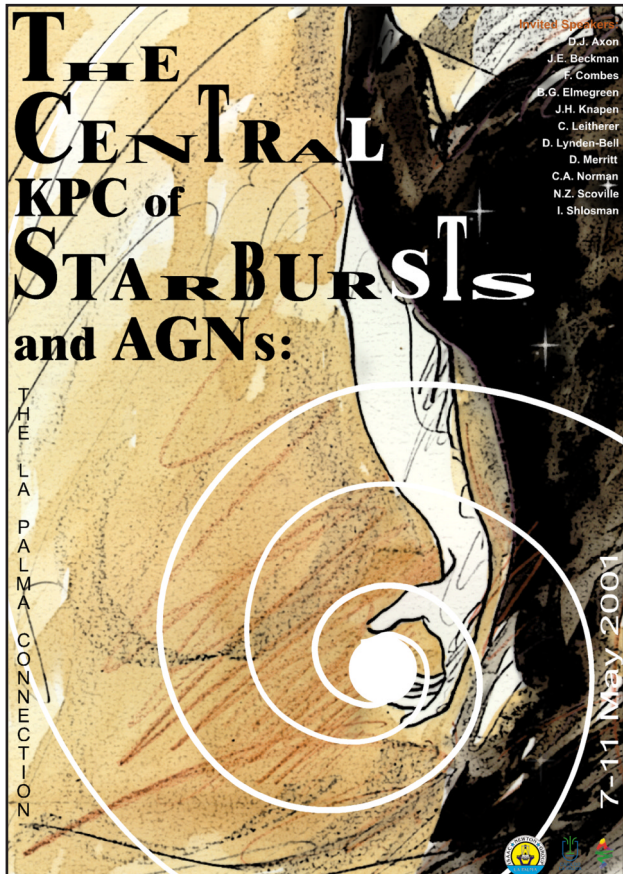


Figure 2. Above: Announcing poster of the “The Central Kpc of Starbursts and AGNs: The La Palma Connection” conference. Below: Conference attendants at the Observatory.

speakers such as Ellis, Pettini, Foy, Davies, Charles and de Zeeuw), a vigorous visitor programme, and staff effort available for long-term student supervision. The last point is noteworthy as long-term students provided support for the JKT, releasing valuable effort for ING projects and research.

In May 2001, over 100 astronomers from around the globe attended the first ING astronomical research conference on “The Central Kiloparsec of Starbursts and AGN: The La Palma Connection”. The conference was held from

May 7 to 11, 2001, in Hotel Hacienda San Jorge in the small resort town of Los Cancajos, located near Santa Cruz de La Palma. The scientific programme included nine oral and two poster sessions, with a dozen invited reviews setting the scene. Long lunch breaks were used for further discussions or collaborative work. The social programme included a lecture on the geography and biology of La Palma and a guided tour of the telescopes at the Observatory.

The fact that many high-resolution studies of galaxies have been made using data obtained on La Palma makes the island a fitting “connection” to the field of study. The central kiloparsec regions of nearby disk galaxies often show profound starburst and/or nonstellar (AGN) activity, accompanied by intricate gas and dust morphologies and kinematics.

The conference was supported financially mainly by the ING, but the Excelentísimo Cabildo Insular de La Palma (Island Government), and its Patronato de Turismo (Tourist Board) made very generous contributions to the social programme. The scientific and local organising committees were chaired by Knapen, with the latter committee made up entirely by ING staff and students. The proceedings of the conference were published at the end of 2001 as a 750-page volume in the conference series of the Astronomical Society of the Pacific, edited by Knapen et al.: “The Central Kiloparsec of Starbursts and AGN: the La Palma Connection”, eds. J. H. Knapen, J. E. Beckman, I. Shlosman and T. J. Mahoney, 2001, *ASP Conference Series*, 249.

INDIVIDUAL RESEARCH ACTIVITIES

Thomas Augusteijn identified the infrared counterpart of the X-ray source 4U 1630-47 and concluded that the source is a black-hole X-ray binary containing a relatively early-type secondary. He has also been involved in an extensive monitoring campaign of the cataclysmic variable TV Columbae, detecting the longest known superhump period. He also continued to work on the Faint Star Variability Survey, one of the Wide Field Survey programmes, and the Calán-Tololo and Hamburg-ESO objective prism surveys. One of the important aims of this work is to derive the true space density of the CVs.

Chris Benn discovered 5 QSOs at redshifts greater than 3.8 from INT observations of QSO candidates from the FIRST radio survey. A subsequent search, again with the INT, yielded a total of 18 QSOs with redshifts greater than 4. He also worked on the use of microJy radio sources

as a measure of star formation rate as a function of redshift, dust extinction in QSOs, and the lunar atmosphere. Chris also produced a citation-based analysis of the relative impact of telescopes worldwide (Benn & Sánchez, 2001) which was widely cited in the literature and was discussed in *Nature* (2000, Nov. 2), **6808**, 12.

Romano Corradi focused on several aspects of the late stages of evolution of single and binary (symbiotic) stars, including the formation of bi-polar nebulae, the formation of small-scale low-excitation microstructures, and understanding the dynamical evolution of PNe. One of the main highlights is the discovery of ‘false’ haloes around PNe — shells which are not signatures of mass-loss events but rather are the result of the effect of a drop in luminosity of the central star. Romano also led searches for new PNe in other galaxies such as M33 and M81, finding 120 new candidates in the latter galaxy.

Begoña García Lorenzo investigated the circumnuclear regions of Seyfert galaxies finding that the stellar kinematical behaviour corresponds to stellar disks while the ionised gas is strongly perturbed by radial motions. She also derived the first measurement of an extinction curve at a cosmological distance, finding evidence for a strong 2175Å feature implying that the widely adopted SMC extinction law for such cases is erroneous. Begoña also continued to work on Blue Compact Dwarf galaxies.

Johan Knapen worked on the morphology and dynamics of disk galaxies, interrelations between the disk and bar, and between the circumnuclear and nuclear regions. A near-IR survey of galaxies obtained with INGRID was used to estimate the gravitational torques of the embedded bars. Knapen also found that Seyfert hosts are preferentially barred as had long been expected but never proven. He also investigated the stellar populations in the nuclear regions of galaxies and found evidence for sequential star formation in the nuclear ring of M100.

Danny Lennon produced the definitive high resolution spectroscopic survey of massive metal poor O-stars in the SMC. The data were used to improve spectral synthesis models of starburst and starforming galaxies. An analysis of the surface of the central star of Sher25, a B-supergiant with a bipolar nebula, demonstrated that this is not a post red-supergiant star as had been supposed. Lennon was also involved in using massive stars as probes of nearby galaxies, examining the abundance gradients in M31 and M33, as well as producing the first stellar abundances in the nearby dwarf irregular galaxy NGC6822.

Roy Østensen worked on pulsations in subdwarf B stars, discovering several new examples of this rare type of short period pulsating star. This work was the photometric follow-up of candidate subdwarf stars selected from the Hamburg-Schmidt survey.

Ian Skillen collaborated on aspects of the distance scale with the aim of investigating abundance effects on distances derived from Cepheids. Preliminary radial velocity curves for 16 field Cepheids derived from echelle spectra have been published.

John Telting found non-radial pulsations in the primary of a close binary system comprising two B-type stars in a 2.5 day period. The pulsational behaviour is similar to single non-rotating stars in the spectral class region of the Beta Cephei stars. The system is the most likely candidate for tidal excitation of pulsations possibly leading to loss of angular momentum. As such it is a key system for understanding close binary evolution and tidal capture.

Nic Walton was the principal investigator on a new Wide Field Survey programme, the Local Group Census, continuing his deep involvement with survey programmes in general. This survey, with strong ING representation, aims at uncovering populations of emission line objects in nearby resolved galaxies. Walton also continued his work on SN, both as cosmological probes and to study their physical processes, and continued to work on extragalactic PNe, in particular studying abundances in Centaurus-A.

Almudena Zurita found that HII regions are the most probable sources of ionisation of the diffuse ionised gas in spiral galaxies. She has also worked on the H-alpha luminosity function, and the calibration of the glitch in its behaviour in HII regions of spiral and irregular galaxies with the aim to using the luminosity function as a standard candle.

In addition to the above, a number of ING scientific and technical staff in zero research time posts contribute to the research atmosphere of the ING through their own interests. Such staff include Robert Greimel (Astronomy Software; high precision radial velocity measurement), Peter Sorensen (Telescope Operator; planetary nebulae), Javier Méndez (Librarian and Public Relations Officer; type Ia supernovae), Marco Azzaro (Telescope Operator; galaxy evolution and mergers), Neil O'Mahoney (Telescope Operator; adaptive optics), Saskia Prins (Astronomy Administration; supernova remnants).