REPORT ON THE ESO WORKSHOP ON

# LARGE PROGRAMMES AND SURVEYS

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DURING THE 1980s ESO introduced "Key Programmes" to make best use of the observational resources. A first assessment of the success of the Key Programmes was done in 1993 and came to the result that the concept had severe shortcomings (cf. *Messenger* article by Cesarsky and Kudritzki 1994, Messenger 75, 45). In particular, a large fraction of the available observing time was committed to these Key Programmes and they were severely limiting the access to ESO telescopes for general users. In addition, the scientific impact of these Key Programmes was not very high. To avoid this mistake for the VLT a working group of community astronomers was formed in 1996 to discuss ways of achieving the best possible scientific return of the VLT. The report suggested introducing "Large Programmes" for projects which would require substantial observing time (more than either 100 hours or 10 nights) for a well-focused scientific goal. The duration of these Large Programmes was limited to no more than two years (four semesters). Up to 30% of the total time available for the community could be committed to Large Programmes. Subsequently it was requested that progress reports be presented to the OPC in each semester. The working group also suggested that "at about the time of the start of operations of UT3 the definition of the Large Programmes and its implementation should be reconsidered." With one telescope entering into operation per year it turned out that this review would be based on more experience by extending the timeline foreseen initially. In 2002 sufficiently many Large Programmes had ended and it was time to assess the impact the Large Programmes have had.

Between the start of VLT operations in 1999 (P63) and 2003 (P71) 47 Large Programmes were approved by the OPC for Paranal and La Silla telescopes. They cover almost all current astronomical topics from the Solar System to the exploration of the cosmological parameters. A list of all approved programmes is given in Table 1. ESO and the OPC thought that a workshop with the Principal Investigators (PIs) of the Large Programmes would be the best way to assess their impact.

## WORKSHOP

During three days, May 19 to 21, 2003, about 70 astronomers gathered in Garching for an assessment of the scientific impact of Large Programmes and to discuss planning for future surveys at ESO. Several members of the OPC and STC actively participated in the workshop.

Every PI of a Large Programme (LP) approved up to ESO Period 69 was invited to present the results of their project. All LPs but one were presented in half-hour talks. A two-hour discussion session was held to assess whether the current scheme of LPs is adequate or should be adjusted.

We experienced very good presentations with a range of very interesting results. After all, these Large Programmes were supposed to be amongst the most exciting current projects. Not all programmes had finished taking data at the time of the workshop, but it was possible nevertheless to get a good overview. The first day of the workshop was devoted to extragalactic topics. The progress on faint, distant galaxies has been truly remarkable. We heard reports about the enhanced clustering of EROs, indications of a new population of distant galaxies that may contain nearly half of the mass at these redshift, the evolution of the interstellar medium and the characterizations of galaxy clusters. The latter are important laboratories for the comparison of observations with theory. Although there was only one presentation on distant supernovae, it can be seen from Table 1 that there are at least three Large Programmes dealing with this topic. The day ended with objects closer to home: a study of dwarf elliptical galaxies and the mapping of gas in the Magellanic Clouds.

The second day was dominated by Large Programmes dealing with stellar astrophysics and solar system objects. Two programmes to study the distribution and nature of Trans-Neptunian Objects have been carried out at ESO. The companions of stars, be they planets, brown dwarfs or other stars have been the focus of a few Large Programmes. While planets have not been found yet, the projects provide important constraints on the formation scenarios of stars and their companions. Stars do not form in isolation and in the formation process change their environment as well. Astrochemistry is a powerful tool to assess the conditions around stars and infer how they formed and what is happening in the process. Two Large Programmes concentrated on the chemical abundances of stars. In one case, stars in globular clusters were investigated to improve their placement in the HR diagram and hence provide better distances, which then constrain the cluster ages and give lower limits to the dynamical age of the universe. The first stars formed are still around and can be observed as metal-poor inhabitants of the Milky Way. While Gamma-Ray Bursts and Supernovae have not been observed in our Galaxy (at least during the existence of ESO), they have stellar progenitors. One Large Programme has been devoted to each problem. The characterisation of the GRBs themselves and their host galaxies is providing more and more clues to the nature of these explosions. A search for progenitor systems of Type Ia Supernovae among the known white dwarfs has been conducted at the VLT and yielded some tentative results. Before the discussion session Jacques Breysacher gave an assessment of the scheduling impact Large Programmes have had.

The general impression was that most LPs have produced excellent results and unique science, which would have been unachievable through regular programmes. They allowed European astronomers to compete directly with the best groups worldwide, some of whom profit from significant access to large telescopes operated by private institutions. A small number of LPs clearly suffered from insufficient manpower to reduce and analyse the data quickly. LPs operated by well-organised teams with a mix of project leaders and young students and postdocs fared very well. In several cases, European expert teams have formed for LP proposals. The LPs have had the effect of unifying the community in certain astronomical fields. In a few cases LPs have been the inspiration or motivation for successful European research networks, several of which have been funded through EU programmes.

The effectiveness of the restriction of LPs to two years duration was recognised as a useful incentive to produce important results quickly, one major reason to originally introduce the LPs. Some discussion about the number of approved LPs took place but no case was made for either decreasing or increasing the 30% limit. It was re-confirmed that LPs should only be approved when they represent excellent projects. To make sure that LPs are compared to the regular programmes, it was suggested that the OPC should consider comments from both subpanels of their respective proposal category.

It was also suggested that ESO should capture the return of the LPs in the form of

# Large Programmes at ESO

| Prog ID | PI | Title |
|---|---|---|
| 163.O-0333 | Arnaboldi | A deep and shallow U imaging survey: preparation to the VIRMOS Deep Redshift Survey |
| 163.H-0285 | Maza | Optical and Infrared Observations of Supernovae |
| 164.O-0089 | Arnaboldi | A deep and shallow U imaging survey: preparation to the VIRMOS Deep Redshift Survey |
| 164.H-0376 | Maza | Optical and Infrared Observations of Supernovae |
| 164.O-0560 | Cimatti | A stringent test on the formation of early type and massive galaxies |
| 164.L-0310 | Forveille | Companions to nearby M dwarfs: Planets, Brown Dwarfs and Stars |
| 164.O-0612 | Franx | Formation and Evolution of Galaxies from Ultra-Deep ISAAC Imaging: A Public Survey |
| 164.O-0561 | Krautter | Public Imaging Survey |
| 164.I-0605 | van Dishoeck | Origin and Evolution of Ices in Star-Forming Regions |
| 165.H-0464 | van den Heuvel | The Physics of Gamma-Ray Bursts (GRBs) and the Nature of their Hosts |
| 165.L-0263 | Gratton | Distances, Ages and Metal Abundances in Globular Cluster Dwarfs |
| 165.N-0115 | Dejonghe | The internal dynamics of Fornax and NGC 5044-group dwarf ellipticals (dEs) |
| 165.N-0276 | Cayrel | Galaxy Formation, Early Nucleosynthesis and the First Stars |
| 165.S-0187 | Hainaut | Very distant TNOs: the Missing Mass of the Solar System |
| 165.I-0402 | Rubio | Deep CO(2-1) observations of molecular regions in the Magellanic Clouds |
| 165.H-0588 | Napiwotzki | Are White Dwarf Binaries the Progenitors of Type Ia Supernovae |
| 166.A-0106 | Bergeron | The Cosmic Evolution of the Intergalactic Medium |
| 166.A-0162 | White | The ESO Distant Cluster Survey: Evolution in Clusters since z~1 |
| 166.A-0701 | Rosati | The Galaxy Population of the most distant Massive Clusters and their Internal Dynamics |
| 167.D-0173 | Gratton | Distances, Ages and Metal Abundances in Globular Cluster Dwarfs |
| 167.C-0340 | Boehnhardt | Physical Properties of the Most Pristine Solar System Bodies: Transneptunian Objects and Centaurs |
| 167.D-0407 | Napiwotzki | Are White Dwarf Binaries the Progenitors of Type Ia Supernovae |
| 167.A-0409 | Miley | Tracing the Formation and Evolution of Clusters and their Central Massive Galaxies to z>4 |
| 167.A-0492 | Fransson | Supernovae at high redshift |
| 168.A-0322 | Franceschini | An ESO-SIRTF Wide-Area Imaging Survey (ESIS), Targeting the History of Cosmic Transformation of Baryons in Stars and Active Nuclei |
| 168.A-0485 | Cesarsky | The Great Obseratories Origins Deep Survey: ESO Public Observations of the SIRTF Legacy/Chandra Deep Field South |
| 169.A-0382 | Lidman | Distant Type Ia SNe and Cosmology: Constraining the Nature of the Dark Energy and Assessing the Importance of Dust and Evolution |
| 169.A-0458 | Franx | Galaxy Mass-to-Light Ratios at z>1 from the Fundamental Plane: Measuring the Star Formation Epoch and Mass Evolution of Galaxies |
| 169.D-0473 | Gratton | Distances, Ages and Metal Abundances in Globular Cluster Dwarfs |
| 169.C-0510 | Beaulieu | PLANET II: A Simultaneous Search for Microlensing and Transiting Planets using a Worldwide Network |
| 169.A-0595 | Boehringer | In-depth XMM-VLT Study of Cosmic Structure and Evolution with Massive Clusters and Groups of Galaxies |
| 169.A-0725 | Krautter | Public Imaging Survey |
| 170.A-0143 | Cimatti | The nature and evolution of infrared galaxies: bridging optical and SIRTF-SWIRE data with |
| 170.A-0519 | Leibundgut | The Ω project: measuring the equation of state of the universe |
| 170.A-0788 | Cesarsky | The great observatories origins deep survey: ESO public observations of the SIRTF Legacy/HST |
| 170.A-0789 | Krautter | Public Imaging Survey: WFI follow-up of XMM-Newton Serendipituous fields |
| 170.A-0790 | Krautter | Public Imaging Survey - GALEX and SIRTF coverage and completion of the Deep Survey |
| 170.D-0010 | Christlieb | Nucleo-chronometric age dating of the oldest stars in the galaxy and the nature of the r-process |
| 171.A-0486 | Pain | Measuring the Cosmic Equation of State and the Star Formation Rate: spectroscopic identification of supernovae in the CFHT Legacy Survey |
| 171.A-3045 | Cesarsky | The great observatories origins deep survey: ESO public observations of the SIRTF Legacy / HST Treasury / Chandra Deep Field South |
| 171.A-3054 | Giallongo | An ultra deep IFU sepctroscopic coverage of the Hubble Deep Field South |
| 171.B-0442 | Tacconi | The dynamics and evolution of galaxy mergers: properties of the 1 Jy ULIRG sample |
| 171.B-0520 | Gilmore | Towards the temperature of cold dark matter: quantitative stellar kinematics in dSph galaxies |
| 171.B-0588 | Tolstoy | Dwarf galaxies: remnants of galaxy formation and corner stones for understanding galaxy evolution |
| 171.D-0004 | Gieren | The Araucaria Project: improving the distance scale with stellar distance indicators in nearby galaxies |
| 171.D-0237 | Smartt | The FLAMES survey of massive stars in the Magellanic clouds |

reduced data and other data products. ESO should explore the capabilities of its archive to maintain the legacy data produced by LPs. When submitting, the proposer should indicate what data products they expect to deliver within which time frame. It was also suggested that a stronger PR effort should accompany successful Large Programmes.

Currently, LPs have to report to the OPC about their progress at each call for proposals. Effectively, a LP can be judged no sooner than about one year after approval. A final report listing the achievements, including publication list, should be implemented.

Overall the LPs are considered a success and should be continued. They provide European astronomers with a chance to achieve important results in a competitive and timely fashion.

### Public Surveys

On the last day the Workshop focused on Public Surveys. The subject was introduced by a series of presentations on survey-related Large Programmes, past and current public surveys, EIS survey infrastructure, other major surveys worldwide, plans for the UKIDSS surveys, VST/OmegaCam and VISTA.

Surveys provide large, homogeneous data sets covering a variety of combinations in the parameter space of multiband, depth and area. Often surveys span longer times and a broader scope than LPs. Out of their database, large uniformly treated products can be generated, which can be used for a variety of scientific purposes.

At ESO, surveys have been handled as LPs in the past years. Some of them have been conceived as Public Surveys, such as the various EIS surveys (e.g. Pre-FLAMES, Deep Public Survey, and the GALEX and XMM follow-up surveys), FIRES and GOODS. Others have been handled as proprietary (or private) surveys, such as the U-band VIRMOS survey and the SWIRE optical follow-up. Many of these surveys are also connected to legacy-type programmes at satellites and other observatories.

Over the past several years the EIS team has developed a Survey System that is now virtually complete and will offer the possibility of processing imaging survey data from a variety of instruments, both optical and infrared.

With VST and VISTA ESO is about to start operation of two survey telescopes in the coming years. Proper planning for the optimal use of these facilities is an urgent need. The UKIDSS surveys will take 1000 nights at the UKIRT telescope over the next seven years and all its products will be public to the ESO community. VISTA will devote 75% of its time to surveys. Both UKIDSS and VISTA will generate a strong demand for complementary data in the optical.

At the end of the workshop a two-hour discussion session focused on the future implementation of surveys at ESO. By and large general agreement emerged on the following issues:

- Surveys will be an important and necessary tool to optimize the science returns of the VLT
- Besides public surveys, there may well be Guaranteed Time Observations and private surveys
- Scientific and scheduling coordination of surveys is essential for a rational and effective use of survey telescopes
- To ensure coordination, surveys should be evaluated as a distinct category with respect to LPs. ESO should establish a proper procedure to ensure such coordination.
- One of the lessons learned from the EIS experience is that stronger involvement of the community in survey production is necessary to ensure the scientific quality of the products and their timely delivery.
- For optimal results to be achieved, effective forms of cooperation between ESO and its community will have to be established.
- For each survey a dedicated team should take the responsibility for survey design and products, while ESO will support the team effort by making available the EIS Survey System through the Visitor Programme.
- Surveys and Virtual Observatory activities should be properly interfaced for mutual benefit.

Surveys will be an important contribution to the science produced with ESO facilities in the forthcoming era of dedicated survey telescopes. New procedures should be followed to ensure timely delivery of high quality survey products for the entire ESO community.

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A Report on a Workshop on

# Future Large-Scale Projects and Programmes in Astronomy and Astrophysics

**Organisation for Economic Co-operation and Development (OECD) - Global Science Forum**

Ian Corbett (ESO)

This workshop was proposed by Germany, which invited ESO to act as host, and took place on December 1-3, at the Deutsches Museum (December 1) and at the Ludwig-Maximilians-Universität (December 2, 3). It was attended by government-appointed delegates from fifteen Global Science Forum Member countries and Observers, three non-OECD countries, representatives of ESO, the President of the International Astronomical Union, invited speakers, and the OECD secretariat, and was chaired by Ian Corbett of ESO.

The Munich workshop is the first of two meetings that are being convened under the aegis of the Global Science Forum. The goal of these workshops is to produce a concise policy-level report, intended primarily for agency officials, programme managers and facility managers, containing consensus findings and conclusions. It is intended to give them a long-term overview of the field and of the issues that governments and community may wish to consider. It will not be prescriptive regarding any particular project or programme. The two principal components of the report will be:

1) A strategic perspective on potential future large facilities or projects during the next 10–15 years, based on important scientific goals, and connections to other fields.
2) An enumeration and analysis of trends, issues, and concerns relevant for long-term planning and priority-setting by government officials and scientific organisations, with an emphasis on prospects for international co-ordination and co-operation.

The report may well recommend follow-on activities. A report on the first meeting was presented to the Global Science Forum in February, which enthusiastically welcomed the progress made.

### Scientific Presentations

Two public keynote presentations, given by Malcolm Longair and Martin Harwit, took place on the evening of December 1. During the following two days, workshop participants heard eight presentations in two general categories: (1) a broad review of the main scientific challenges in the field of astronomy, focussing on the key unanswered questions and the type of information that is sought by researchers, and (2) a survey of the principal observational and technological advances that are needed, with an emphasis on those areas that offer opportunities for