A New Massively-multiplexed Spectrograph for ESO

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With the advent of many large-area imaging surveys in recent years, the need for a new facility for spectroscopic surveys has become apparent. Following a recommendation from the Science and Technical Committee, ESO made a call in 2010 for wide field spectroscopic instrument proposals among its community. Two of the ten proposals were selected for a competitive Phase A study. This article describes the selection process and two associated articles present the instrument concepts.

Large-scale observational surveys are powerful tools for advancing many astronomical fields, often opening up new directions of research, whether the goal is a statistical understanding of a particular class of source or the search for rare objects. In the optical and infrared many new ground-based imaging surveys are underway (e.g., WFCAM, VISTA, Pan-STARRS), are about to start (VST) or in the planning stages (Large Synoptic Survey Telescope, LSST). These imaging surveys will yield catalogues of hundreds of millions of sources and target scientific fields from gravitational lensing to the star formation history of the Galaxy, such as for VISTA and VST (Arnaboldi et al., 2007). In space, Gaia will provide an unprecedented catalogue of positional and radio-velocity information for about a billion stars and the eRosita mission will explore the nature of dark matter and dark energy with an all-sky X-ray survey. These survey projects will deliver new results in the second half of this decade which will demand spectroscopic follow-up. The requirement for a highly-multiplexed spectrograph was identified in the ASTRONET Infrastructure Roadmap (Bode, Cruz & Molster, 2008) as a high priority for exploiting these, and other, missions and as a standalone facility. The ESO Science and Technology Committee (STC) has recommended that steps be taken to improve the existing ESO capabilities in this field.

In 2010, ESO launched a call for proposals for the conceptual design of a multi-object spectroscopic (MOS) instrument/facility for carrying out public surveys. Up to two proposals were to be selected for a competitive Phase A study. The call for proposals was very broad and stated that the instrument should provide the ESO astronomical community with the ability to carry out original wide-field spectroscopic science. Beyond this requirement, the instrument concept and the detailed scientific goals were left open. Proposals were solicited for any ESO telescope: upgrades to existing instruments or completely new instrument concepts were both within the scope of the call. Even proposals for non-ESO telescopes were permissible. In total, ten letters of interest, describing in brief the proposal concept, were sent in by the community. Six teams were invited to submit full proposals consisting of a scientific and technical report and a management plan for the design study.

The final proposals were delivered on 1 March 2011 and included over 30 institutions and 160 contributors, demonstrating the wide interest in such an instrument. The quality of the submitted scientific and technical ideas was warmly appreciated by ESO and the panels involved in the evaluation of the instrument concepts.

The proposals were reviewed from a technical and scientific perspective by separate panels. The technical panel consisted of engineers and scientists from within ESO. The technical review addressed the quality of the technical case for the instrument concept, including the level of risk involved in the design, the quality of the management plan and the experience of the team. The important factors of the impact on the telescope and the operational model for the instrument were also considered.

The scientific panel was made up by a 50:50 split of astronomers from the community and from ESO. It commented on the major scientific questions to be answered by the instrument, whether the science case would be interesting and competitive on the timescales of 2016 and beyond and whether the instrument concept presented would address those goals.

Each panel was charged with commenting on the suitability of the proposals for further study. The proposals were for six very powerful and very different instruments. These included slit- and fibre-based spectrographs, covering the optical and near-infrared wavelength ranges and were for the VLT, VISTA and the NTT. Although some of the projects were judged to be very challenging and ambitious, no technical show-stoppers were identified. The scientific committee strongly endorsed the 2017 delivery timescale envisaged for the instrument as being required for Gaia and eROSITA follow-up. The requirement for high spectral resolving power ($\lambda/\delta\lambda >$ 10 000) for optimal exploitation of Gaia was stressed. The possible selection of Euclid at the end of 2011 by ESA is expected to have an important influence, as the science goals of its spectroscopic instrument overlap with this project.

Overall, the science panel reached excellent agreement as to the most suitable proposals for further work. Finally, ESO management received the input from the two committees and selected the concepts for study. Their recommendation was presented to the Science and Technical Committee at its April 2011 meeting. The successful proposals are for MOONS — a fibre-fed infrared spectrograph designed for the VLT, led by Michele Cirasuolo from the UK Astronomy Technology Centre, and for 4MOST — a fibre-fed optical spectrograph, led by Roelof de Jong from the Leibniz-Institut für Astrophysik Potsdam. Conceptual designs for 4MOST on both the VISTA and NTT telescopes will be explored by the team before the selection is made at the midterm of the design study. In the following two articles the scientific and instrumental aspects of the two proposals are summarised.

The Phase A for the two instruments will finish in February 2013. It is expected that one of the instrument concepts will then be recommended to the STC for detailed design and construction. ESO's goal is to offer a new spectroscopic facility on one of its telescopes around 2017.

References

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