

detection in Centaurus A may be a consequence of orientation.

An old problem, relevant to both AGN jets and star formation, is how to distinguish between vector-ordered and disordered but anisotropic field topologies, as both are capable of producing high degrees of polarisation. Carole Mundell considered both topologies in her discussion of AGN and gamma-ray burst sources. Monica Orienti pointed out that the degree of field ordering may also help to distinguish between particle acceleration mechanisms, for example in hot spots of radio galaxies.

Although the main theme of the workshop was interferometric imaging of polarisation, observations of the CMB with bolometric arrays were also discussed by Sean Bryan. There are well-known and exciting applications of CMB observations, including the potential detection of cosmological B-modes, but also a number of synergies, both observational (polarised point sources, foreground

subtraction) and technical (improved lens materials for millimetre-wave receivers).

The meeting served a valuable purpose by identifying priorities for future developments in instrumentation. In rough order of importance, these were agreed to be:

- Very accurate circular polarisation calibration in continuum and line (Zeeman effect).
- Improved efficiency of polarisation calibration, avoiding the need for large parallactic angle rotation during an observation.
- Wider frequency coverage (for example, extending polarisation observations to the ALMA Bands 8–10).
- Lower systematics for measurement of linear polarisation, both to measure polarisation fractions $< 0.1\%$ in protoplanetary discs and to achieve high dynamic range for total intensity.
- Polarisation calibration over the primary beam, for example using Mueller matrix methods. This is essential for ALMA polarisation mosaics.

All of the presentations are linked on the meeting website¹ and are available through the SAO/NASA Astrophysics Data System database.

Demographics

There were 62 registered participants at the workshop (Figure 1), three quarters of these coming from European institutions. One-third of all participants were women, and a similar fraction were early-career researchers, i.e., Masters and Doctoral students or junior postdoctoral scientists.

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Links

¹ QUESO Programme: <https://www.eso.org/sci/meetings/2017/QUESO2017/program.html>

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Report on the MOSAIC Science Colloquium

Spectroscopic Surveys with the ELT: A Gigantic Step into the Deep Universe

held at the Toledo Congress Centre, Toledo, Spain, 17–19 October 2017

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The Phase A design of MOSAIC, a powerful multi-object spectrograph intended for ESO's Extremely Large Telescope, concluded in late 2017. With the design complete, a three-day workshop was held last October in Toledo to discuss the breakthrough spectroscopic surveys that MOSAIC can deliver across a broad range of contemporary astronomy.

ESO's Extremely Large Telescope (ELT) will be the world's largest optical/infrared facility for at least a generation. It will have an immense collecting area, equivalent to gathering together all the current large telescopes in use today. Multi-object spectroscopy (MOS) will be a key

capability of the ELT, able to harness its unprecedented sensitivity to deliver unrivalled surveys of the Universe. The MOSAIC design combines high-multiplex near-infrared and visible spectroscopy, together with adaptive optics (AO) spectroscopy in the near infrared that exploits the fantastic angular resolution of the ELT across a large field of view.

The workshop opened with the latest news on the ELT project from the ELT Programme Scientist, Michele Cirasuolo, and with overviews of the scientific motivations and technical design of MOSAIC, which were presented by François Hammer and Myriam Rodrigues. These were followed by talks that helped set the scene of the broader landscape in the



Figure 1. Workshop participants assembled in the Toledo Congress Centre.

mid-2020s, including Luca Pasquini presenting future developments at ESO's La Silla Paranal Observatory, Andrew Hopkins talking about the innovative TAIPAN survey underway on the UK Schmidt telescope and Suresh Sivanandam describing plans for an AO-fed MOS at the Gemini Observatory.

The ensuing science sessions spanned the diverse and wide-ranging topics that MOSAIC will address, namely the first galaxies and active galactic nuclei, galaxy evolution, the intergalactic medium, extragalactic stellar populations, and Galactic surveys. The sessions featured invited talks on the latest science results and relevant instrumentation developments. For example, Emma Curtis-Lake presented plans for Guaranteed Time Observations of high-redshift galaxies with the James Webb Space Telescope (JWST); Armando Gil de Paz provided tantalising glimpses of the first observations from the new Gran Telescopio Canarias (GTC) instrument, Multi-Espectrógrafo en GTC de Alta Resolución para Astronomía (MEGARA); Olivier le Fèvre reflected on lessons learned from past high-redshift surveys and future aspirations with the JWST and ELT; Oscar Gonzalez talked about future surveys of the Milky Way bulge with the VLT third-generation instrument, Multi Object Optical and Near-infrared Spectrograph (MOONS) and MOSAIC; and finally there were results from the ESO Public Surveys carried out on the VLT MOS instrument VIMOS — Large Early Galaxy Astrophysics Census (LEGA-C) and VANDELS, which were presented by Arjen van der Wel and Laura Pentericci, respectively.

In addition to the contributed talks on recent results and ideas for MOSAIC surveys, the programme featured invited and contributed talks on detailed MOSAIC simulations using the Websim-Compass simulator (Puech et al., 2016), including: the first galaxies (Karen Disseau); galaxy rotation curves and dark matter (Jianling Wang); intergalactic medium tomography (Jure Japelj); high-redshift dwarf galaxies (Arjan Bik); and extragalactic massive stars (Oscar Ramírez-Agudelo).

Thinking about future ELT surveys, the final discussion focused on those that will be truly unique as they are not possible with other facilities. Participants converged on four key science cases which are potentially the most transformational and which will influence future decisions in instrument development. These are:

- First-light galaxies: Lyman- α emitters and physical properties;
- Inventory of matter: baryons and dark matter;
- Extragalactic stellar populations: evolved populations beyond the Local Group;
- Evolution of dwarf galaxies: formation, evolution and contribution to reionisation.

The meeting helped to demonstrate the high levels of enthusiasm and significant demand for MOS observations on the ELT. Ahead of the start of Phase B of instrument development, the advanced simulations presented in Toledo will be published, and new topics identified in the meeting will also be investigated in greater detail.

After the meeting, participants had an opportunity to visit the historic Marqués de Valdecilla library of the Universidad Complutense de Madrid (UCM) in Madrid, followed by an event presenting the MOSAIC concept to national media and senior officials of the Spanish Ministry and UCM.

Demographics

In total there were 75 participants (52:23 male:female), 20 invited presentations (14:6 male:female), and 17 contributed talks (11:6 male:female), with a good mix of senior and junior faculty and early-stage researchers.

Acknowledgements

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References

Puech, M. et al. 2016, Proc. SPIE, 9908, 9P

Links

- ¹ MOSAIC meeting webpage, including links to the presentations: <https://www.mosaictoledo.org>
- ² Further information and contact details are available at: <http://www.mosaic-elt.eu>
- ³ The WEBSIM-COMPASS simulator for MOSAIC observations: <http://websim-compass.obspm.fr>