Adaptive optics corrected imaging for satellite and debris characterisation

Michael Copeland[1,2], Francis Bennet[1,2], Francois Rigaut[1,2], Visa Korkiakoski[1,2], Ian Price[1,2], Celine d'Orgeville[1,2], Craig Smith[2,3]

[1]Research School of Astronomy and Astrophysics, Australian National University, Canberra, Australia, [2]Space Environment Research Centre, Weston Creek, Australia, [3]EOS Space Systems Pty Ltd, Queanbeyan, Australia

Space debris poses a significant threat to ongoing space operations as a single collision can cause catastrophic damage to a spacecraft. The Research School of Astronomy and Astrophysics (RSAA) at the Australian National University (ANU), in partnership with the Space Environment Research Centre (SERC Limited), is developing adaptive optics systems for space situational awareness. Adaptive Optics Imaging (AOI) is a system for imaging satellites and debris in low Earth orbit (LEO) and geostationary orbit (GEO). The system operates on a 1.8 m telescope located at Mount Stromlo Observatory.

Observations of objects in LEO will be used to make size, shape and orientation characterisations. With AOI we will identify features of satellites in LEO such as body shape, solar panels and changes over time for rotational measurement. We can resolve objects 50 cm in size at 800 km range and 850 nm wavelength with AOI.

We will achieve high precision tracking of objects in GEO by measuring position relative to a reference star from the Gaia catalogue. Satellites will be tracked as they pass within 15 arcseconds of the reference star and the position will be measured with an accuracy of approximately 1 m for objects 1 m² or larger.

We will present on-sky observations of AOI in natural guide star mode. We will employ a range of imaging techniques to determine the scenarios which provide optimal imaging quality. In 2019 the system will be upgraded with a laser guide star which will enable fainter objects to be imaged.