

IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
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RESEARCH CAPABILITIES OF THE NEW AUSTRALIAN QUANTUM OPTICAL
COMMUNICATIONS GROUND STATION

Abstract

The Australian National University's Quantum Optical Ground Station (QOGS) has been newly commissioned at Mt Stromlo, Australia. The facility features a Planewave RC700 telescope with multiple instrument ports and will be equipped for optical communications with spacecraft from LEO orbits through to lunar distances, as well as Quantum enhanced communication such as Quantum Key Distribution (QKD) demonstrations. The facility features a ground floor laboratory fed by a Coudé path allowing easy installation of large scale or visiting instruments.

Capabilities under construction include a variety of optical communications schemes including the High Photon Efficiency (HPE) scheme for lunar distances, coherent, and on-off keying standards. Subsystems enabling these techniques include equipment such as Superconducting Nanowire Single Photon Detectors (SNSPDs), electronics, and modems. A custom array of transmitters for uplink communications and beacons with individualised tracking and steering for point ahead will also be deployed. While the equipment currently being deployed supports the 1550 nm bands, the facility is capable of supporting wavelengths from 450 to 1600 nm.

The effects of atmospheric turbulence are being mitigated through the development of adaptive optics (AO) systems for both classical and quantum optical communications. The facility is currently being upgraded with a cost-effective AO design to enhance high-performance communication scenarios such as high-data rate and low-loss quantum communications.

The geographical isolation and size of Australia makes it an ideal location for a network of optical ground stations. Investigations into the ideal number and location of expansion sites have been performed considering cloud cover statistics and capacity implications. Ongoing development and deployment of low cost turbulence profiling systems is also informing this work and future deployment of additional optical ground stations.