Multi-Object Adaptive Optics Performance for the Gemini InfraRed Multi-Object Spectrograph Instrument

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Abstract

Developing and exercising Multi-Object Adaptive Optics (MOAO) technique on 8-meter class telescope is crucial and required to pave the road for the next generation of MOAO-assisted instruments to be installed on future 30-meter class Telescopes (ELT). The Gemini InfraRed Multi-Object Spectrograph (GIRMOS) is a new facility instrument for Gemini North Telescope using state-of-the-art Adaptive Optics (AO) correction in order to fully take advantage of the telescope's diffraction capability for imaging and spectroscopy. In this work, I will present (1) the GIRMOS MOAO system design, (2) the AO performance modelling, and (3) the risk mitigations activities related to MOAO.
(1) The Adaptive Optics (AO) system of GIRMOS is designed around a two-stage framework. First, a Ground Layer AO (GLAO) correction over a 2 arcminutes field-of-regard is carried out by the Gemini North AO facility (GNAO). Second, an additional MOAO correction is performed by GIRMOS for each of its four Integral Field Unit (IFU) spectrographs. The choice of this specific two-stage architecture will be discussed in detail. An additional goal of the combined instrument is to demonstrate the key capability of AO and MOAO technique on 8m telescopes. Thus, providing the critical experience and technology necessary to develop a future 2nd generation MOAO instrument on ELTs.

(2) Using numerical simulations, we developed a framework to model the full chain of GNAO-GIRMOS AO performance under different atmospheric conditions and configurations at Mauna Kea. We demonstrated the performance on real distant galaxies data. This AO performance modelling was integral to the design of the GIRMOS instrument.
(3) For risks mitigation, we developed a prototype in the laboratory to characterize and exercise calibrations and open-loop AO, as required by the MOAO technique. In addition, we are performing on-sky open-loop experiment using the REVOLT platform on the Dominion Astronomical Observatory 1.2m telescope.

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