Sparse Aperture Masking with the ELT: lessons learnt from the VLT/SPHERE instrument

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Abstract

Sparse Aperture Masking (SAM - a.k.a Non-Redundant Masking, NRM) consists in inserting a pupil-plane mask with several apertures in a non-redundant configuration. This mode transforms the single-dish telescope pupil into an set of sub-pupils to be treated as a Fizeau interferometer. This observing mode brings a unique discovery space by improving the angular resolution by a factor 2, at a cost of a lower sensitivity. We used the SPHERE high-contrast instrument currently installed at the VLT to characterise the limitations of its SAM mode with extrem AO simulated data, internal source data and on-sky data. This analyses took into account the lessons learnt from the high-contrast limitations diagnosed beforehand. As two of the ELT first light instruments (namely METIS and MICADO) will include a (non publicly offered) SAM mode, we extrapolated this work to the capabilities of the SPHERE SAM mask with an ELT-like AO system. This work gives information on the consequences of missing M1 segments and large spider width on the ELT.

Keywords: Sparse Aperture Masking, Non, Redundant Masking, Interferometry, Missing segments, ELT Operation

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