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Direct Imaging of Exoplanets, from very large to extremely large telescopes

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Abstract

Presently, dedicated instruments at 8-m class telescopes (SPHERE for the VLT, GPI for Gemini) are about to discover and explore self-luminous giant planets by direct imaging and spectroscopy. In a decade, the next generation of 30m-40m ground-based Extremely Large Telescopes (ELTs) have the potential to dramatically enlarge the discovery space towards older giant planets seen in reflected light and ultimately even a small number of rocky planets.

In order to fulfill the demanding contrast requirements of a part in a million to a part in a billion at separations of one tenth of an arcsecond, the seeing limited PSF contrast must gradually be improved by eXtreme Adaptive Optics (XAO), non-common path aberration compensation, coronagraphy, and science image post-processing. None of these steps alone is sufficient to leap the enormous contrast. High-contrast imaging (HCI) from the ground encompasses all those disciplines which are to be considered in a system approach.

The presentation will introduce the principle of HCI and present the current implementation in the SPHERE, ESO's imager for giant exoplanets at the VLT. It will then discuss requirements and necessary R&D to reach the ultimate goal, observing terrestrial Exoplanets with the next generation of instruments for the ELTs.