High-contrast interferometry : data reduction in the roadmap to rocky temperate exoplanet characterization

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High-contrast observations have been contributing to detections and characterizations in the long-period part of the exoplanet landscape. The advent of nullers such as Asgard/NOTT at VLTI, functioning as coronagraphs for interferometers, should unlock comparable performance at angular separations smaller by a factor 20, opening up resolved observations of giant planets at the snow line of young stars, and even hot Jupiters around nearby stars. In the coming twenty years, interferometry could complement reflected light observations with mid-infrared spectra of thermal emissions carrying crucial informations of temperature, radii, and greenhouse effects in action.

High-contrast imaging, whether with single dish coronagraphs or with long baseline in nulling interferometry make use of carefully designed and adjusted optics to set-aside the on-axis light of the star and prevent its contamination of the off-axis light present in its scientific channels. The leftovers of these operations constitute so-called leakage light and speckle residuals, which tend to dominate the error budget and are handled through post-processing. Both nulling and coronagraphic techniques face similar challenges of non-Gaussian distributed, correlated errors and mixed multi-planet signals which are challenging at the data reduction level.

I will present new innovative tools proposed by the nulling community to face and solve these challenges and emphasize some of the impact they have on the way we envision the interpretation of these results, not just for nullers, but also for coronagraphs. I will then highlight the commissioning and exploitation of Asgard/NOTT as one of the steps in a roadmap towards future space missions such as LIFE which will characterize dozens of rocky temperate exoplanets in the mid-infrared, exploring key elements of the climate and chemistry of their atmosphere.