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Hot COFFEE news: a status of the coronagraphic phase diversity.

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Summary

Imaging exoplanets is a challenging task. Current ground-based exoplanet imagers such as SPHERE reach contrast levels of 10^{-6} in H-band at 0.5 arcsec; and future space-based instruments will aim for contrast levels better than 10^{-9}.

Such high contrast imaging is enabled by the use of coronagraphs, devices which reject the on-axis starlight but let out-of-axis light from disks or planets pass through. However, any optical aberration in the instrument causes light to leak through the coronagraph, which results in speckles appearing in the focal plane of the telescope. Consequently, it is necessary to measure the optical aberrations after the coronagraphe in order to compensate them. Several methods have been developed in order to measure the wavefront aberrations, such as the low-order coronagraphic wave-front sensor, Zelda, the self-coherent camera (SCC), and the coronagraphic phase diversity.

In this presentation, we will give an overview of the coronagraphic phase diversity from its inception to its recent extensions.
We will recall the principle of the method, and its application to the compensation of aberrations on SPHERE using an internal source. We will expose its extension to the measurement of quasi-static aberrations through post-AO residual turbulence, which enables the use of COFFEE on-sky during observations. We will present its adaptation to the calibration of both phase and amplitude aberrations calibration for space-based instruments. We will present how it adapts to segmented mirrors. Finally, we will discuss how it can complement other wavefront sensing or control techniques, with a focus on recent experimental results concerning the "non-linear dark hole".

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