

Detection of extrasolar earth-like planets: a new challenge for space interferometry

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This paper presents the recent astrophysical challenges of planets detection and focuses on related instrumentation issues of "nulling" interferometry, a powerful technique to search for new exoplanets. This method can combine simultaneously the high dynamic range and high spatial resolution requirements to detect an earth-like planet which is about $1e6$ times fainter than its parent star and separated from it by less than 100 milliarc seconds. Thus, ESA has promoted such a technique through the space-based "nulling" interferometer mission "Darwin" planned for 2015. However, this project addresses new technological challenges, in particular concerning the design of the mid IR beam combination optical system, which, in a space mission context, requires a very high stability. Thus, we propose to use a single-mode "integrated optics" (IO) concept to incorporate on single optical chip functions like wavefront filtering and combination of multiple beams. To date, we have obtained first IO prototypes operating for the mid IR range. The results of the characterization work in laboratory have enlighten the potential of two specific technologies based either on dielectric or metallic waveguides. A presentation of the future expected prospects of mid-IR integrated optics for space-based astronomy underline the potential of such an initiative for the Darwin mission.