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Title: Impacts of a prior identification of potentially habitable planets by an astrometric mission on the capabilities of future spectroscopic missions

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Abstract:

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We estimate the number of potentially habitable planets that can be analyzed in spectroscopy by coronography and external occulter missions (in visible), and interferometer ones (in thermal IR), in two situations:
(i) with no prior identification of the relevant stars, and
(ii) with prior identification.

We conclude to a major advantage of case (ii) for several of the concepts, and find that only an astrometric instrument with an extreme accuracy can perform an exhaustive identification around the nearest stars, and obtain the planetary mass without ambiguity, a key piece of information for qualifying/falsifying a possible detection of a gas mixture that is candidate for a biosignature.

We describe the different possibilities we foresee with an emphasis on the single mirror telescope and Free Flying solution, which is the present baseline of the Neat project to be proposed to ESA for its M4 mission, in 2014. The two spacecrafts are separated by 40 m, which allows working in the diffraction limit with current CCD detector technology. We report the current state of the laboratory breadboarding at IPAG (Grenoble) that aims at demonstrating our capability to measure the distance between the centroids of two stellar images, at the level of 5 micro-pixel.

We also present an alternative solution, a multi-mirror telescope, which is currently considered in the Chinese-led project, STEP, where the secondary and tertiary mirror defects are calibrated in order to differentially measure the stellar positions at the required accuracy (50 nano-arcsecond, 1 sigma)