Measuring the masses of the habitable planets around the 50 closest solar-type stars with Theia.

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Abstract

A major goal of exoplanetary science is the search for possible biosignatures on planets where life similar to ours would have emerged and modified the atmosphere. These planets can be detected by remote sensing using spectroscopic observation of O2, O3, H2O, CO2, and CH4 gases, but in the present context of funding, only missions in the range B$1-2 are seen as feasible for the next decades. This cost cap imposes serious constraints on the number of accessible targets limiting the exploration to the ˜ 20 nearest systems with space coronagraphy in the visible wavelength range and ˜ 40 systems with space interferometers working in thermal IR. It is thus imperative that promising target be identified ahead of time, to minimize several classes of risks intrinsic to the 'blind search' approach. Furthermore, the masses and the three-dimensional orbits of such habitable planets are key elements for deriving exobiological statements in the future, even the most basic ones. The mission called Theia has been submitted to the ESA call for M4 mission in 2015. Theia is a space observatory able to carry out high precision differential astrometry at the sub-microarcsecond level that allows mass determination of Earth-mass habitable planets around the 50 closest Solar-type stars using 15 - 20 % of the time of a three years mission. Theia is a single telescope designed to perform high accuracy astrometry using interferometric calibration and operating in L2. We will present the mission and its capability to measure the mass and orbit characteristics of the 50 closest planetary systems down to the Earth mass in the habitable zone of solar-type stars.

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