

Z304a **Large Interferometer For Exoplanets (LIFE):Phase-space synthesis decomposition for planet detection and characterization**

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Large Interferometer for Exoplanets (LIFE) is a future mission concept to characterize thermal light from habitable planet candidates around Sun-like stars. However, one of the main challenges for achieving this ambitious goal is a high-precision stability of the optical path difference (OPD) and amplitude over a few days for planet detection and up to a few weeks for in-depth characterization. Here we propose a new method called phase-space synthesis decomposition (PSSD) to shorten the stability requirement to minutes, significantly relaxing the technological challenges of the mission. Focusing on what exactly modulates the planet signal in the presence of the stellar leak and systematic error, PSSD prioritizes the modulation of the signals along the wavelength domain rather than baseline rotation. Modulation along the wavelength domain allows us to extract source positions in parallel to the baseline vector for each exposure. The sum of the one-dimensional data converts into two-dimensional information. Once the planets are detected, the modulation signals while rotating the baseline can be estimated and separated from the stellar leak through the singular value decomposition without prior assumptions for each spectral element. In the numerical simulations, we found that PSSD could shorten the duration of the stability to a few minutes and relax the requirement on the stability of OPD by a factor of 10.