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Exoplanet pollution in transit spectroscopy with the next-generation of infrared space telescopes

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The next generation of space telescopes is expected to deliver transmission spectra of exoplanet atmospheres with precision down to 10 parts per million (ppm). Therefore, it is required to model the astrophysical signals with even greater precision in order not to introduce significant biases for the characterization of the planet and its atmosphere.

We discuss, in particular, the contribution of the planetary flux in the analysis of transit observations. Usually, the planetary flux is assumed to be a negligible fraction of the stellar flux, so called *dark planet* hypothesis. However, this hypothesis is not always valid, especially at the infrared wavelengths, around the peak of thermal emission from the planet. We identify two effects, named *self-blend* and *phase-blend*, that tend to bias the measured transit depth in opposite directions (the *self-blend* effect was already known from Kipping & Tinetti 2010).

We introduce a novel sub-package of the software ExoTETHyS that can be used to estimate the amplitude of these two effects depending on the exoplanet system parameters, along with the derivation of the mathematical formulae. In this way, it is possible to identify some priority targets to observe longer transit windows, the secondary eclipse and/or the full phase-curve in order to reduce these potential biases.

We also show the impact of the *self-* and *phase-blend* effects in the analysis of simulated transit spectra taken with the James Webb Space Telescope (JWST), including the results of the atmospheric retrievals. Our analysis takes into account the possible mitigation depending on the alternative data detrending methods.