The study of exo-climates with EChO

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The last ten years of exoplanets detection lead to the discovery of many worlds with very different properties. The EChO mission will characterize with a much better accuracy the atmosphere of those worlds and the many ones yet to be discovered, from hot and massive worlds to temperate super-earth. Understanding the energy balance of the atmospheres, what sets the chemical composition and thus the opacities is crucial for the future understanding of the data collected by the EChO mission.

Here we will review different mechanisms that sets the composition of exoplanets atmospheres. We will study the role of infrared cooling of the upper atmosphere of irradiated planets through 1D analytical radiative transfer models that takes into account non-grey opacities in both the visible and the thermal bands.

Then we will focus on close-in, tidally locked planets, targets where EChO will show its full potential and provide exquisite data. Based on the 3D modeling of hot-Jupiters dynamics, we will discuss how the asymmetric irradiation, coupled to the atmospheric circulation on those planets, can strongly affect their global atmospheric composition and, in particular, the presence and asymmetric repartition of clouds.

The giant step forward by EChO in characterizing the thermal structure, chemical composition and cloud repartition of exoplanets atmospheres will constrains the thermal, chemical and dynamical models, expanding the study of climate to planets outside the solar system.