The mid-infrared spectrum of Beta Pictoris b: first VLTI/MATISSE observations of an exoplanet

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Abstract

Interferometry has made a spectacular entrance in the exoplanet field in the last five years with GRAVITY at the VLTI, providing astrometry and K-band medium-resolution spectroscopy of a few dozen substellar companions. The 100-meter interferometric baselines allow for the stellar and planetary signals to be efficiently disentangled at closer angular separations ($<$ 0.3") than direct imaging. Since 2023, this technique has been extended to the mid-infrared thanks to the GRA4MAT subsystem on the MATISSE instrument. The new fringe tracking and off-axis pointing capabilities increase MATISSE's sensitivity and put exoplanets in reach. We demonstrated this new capability by observing the young giant planet Beta Pictoris b in L and M bands with MATISSE. We obtained a high-signal-to-noise spectrum of Beta Pictoris b, presenting for the first time the planet continuum between 2.7 and 5 μm, which contains broad absorption features of CO and H2O. During this talk, we will present these promising first MATISSE exoplanet observations, and outline the perspectives of characterizing fainter and closer-in exoplanets in the future, in particular in the context of the VLTI upgrade, GRAVITY+. The mid-infrared region is understudied at the moment while being particularly rich in molecular signatures of cooler giant planets. Its study opens new windows on the formation and atmospheric dynamics of these objects.

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