# The search for exoplanetary upper-atmospheric ion $H_3^+$

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We have proposed to detect NIR emissions from the major ionospheric ion, $H_3^+$, in the upper atmosphere of an exoplanet for the first time. Our target is GJ 504b, a Jovian exoplanet resolved around a solar-type star. It has a separated from its host star of 2.5″ and we intend to use the Keck telescope to obtain a spectrum with minimal stellar contamination on April 12 2022. Such a spectrum can be used to derive column integrated densities and temperatures of $H_3^+$, parameters that have for decades given a fountain of insights about gas giant upper atmospheres. GJ 504b is known to exhibit methane absorption, so $H_3^+$ emission lines will appear above a dark background near 3.5 $\mu$m due to a deep methane absorption band, as at Jupiter. A positive detection means the discovery of an exo-ionosphere with (likely) exo-auroral and magnetospheric activity. A null-result would provide evidence for GJ 405b's magnetic field being comparable or weaker than Jupiter's.

Since our observation night is on 12th April 2022, we will need to be lucky with the weather in order that I can present some results of a detection or non-detection. If the weather is bad, or something else prevents the observations, I will simply present our plans and how we intend to execute them.

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