Exoplanet detection and characterization with moderate resolution spectroscopy

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Abstract

Moderate to high-resolution spectroscopy can resolve molecular features in exoplanet atmospheres and therefore allows precise measurements of atmospheric composition. Identifying trends in the present day composition of exoplanets, such as metallicity or carbon to oxygen ratio, can then inform their formation pathways. Additionally, higher-resolution integral field spectroscopy is a powerful tool for planet detection. It is virtually insensitive to the speckle noise from the host star, which is the limiting factor for high-contrast instruments at small separations (< 0.3"). We are demonstrating the power of this technique with a pilot survey of nearby star forming regions with Keck/OSIRIS. We show that moderate resolution integral field spectroscopy is able to detect planets closer to the star than classical high-contrast imaging instruments and deeper than non-redundant masking in the 0.05-0.3 arcsecond regime. The future integral field spectrographs, including JWST and first light instruments on the extremely large telescopes (ELT) such as ELT/HARMONI and ELT/METIS, are poised to become the next generation of planet detection facilities.

Keywords: Direct Imaging, Exoplanet detection methods, High contrast techniques, High resolution spectroscopy

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