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Atomic Spectroscopy of the Solar Atmosphere to Enable Earth-like Exoplanet Detection TIMOTHY MILBOURNE, NICHOLAS LANGELLIER, AAKASH RAVI, CHRISTIAN DOLLIFF, Physics Department, Harvard University, DAVID PHILLIPS, Harvard-Smithsonian Center for Astrophysics, RONALD WALSWORTH, Physics Department, Harvard University; Harvard-Smithsonian Center for Astrophysics — The radial velocity (RV) method has proved to be one of the most prolific means of exoplanet detection. This technique uses measurements of periodic Doppler shifts of the stellar spectrum to deduce the mass and semi-major axis of orbiting exoplanets. The detection an Earth-like exoplanet orbiting a Sun-like star requires RV sensitivity below 10 cm/s (corresponding to kHz shifts of GHz-wide spectral lines). The installation of a laser-frequency "astro-comb" at the High Accuracy Radial velocity Planet Search for the Northern Hemisphere (HARPS-N) spectrograph on La Palma has enabled such observations. Exoplanet measurements is now limited by the noise of the stars themselves: sunspots, convection, and other types of stellar activity produce RV variations on the order of m/s, far above the detection threshold for Earth-like planets. Here, we use the Sun as a test case to better understand RV variations due to stellar activity. By comparing solar spectra taken by a purpose-built Solar Telescope on La Palma with images taken by the Helioseismic and Magnetic Imager (HMI) onboard the Solar Dynamics Observatory (SDO), we hope to identify feature in the solar spectrum which are correlated with solar activity. Such correlates will allow us to build more sophisticated models of stellar activity, and will enable more precise measurements of Earth-like exoplanets.

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