Title:	To Mitigate the Effect of Moonlight Contamination in Spectroscopic Searches for Extrasolar Planets
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Abstract:	Radial velocity (RV) exoplanet detection is undergoing an ongoing race to reach higher and higher levels of precision, motivated by the need to detect Earth-mass planets in the habitable zone. Lunar and atmospheric scattering of sunlight, which results in systematic errors in stellar radial velocity (RV) measurements, can significantly degrade the 10 cm s −1 sensitivity required to detect and characterize terrestrial exoplanets in or near habitable zones of Sun-like stars. With mask-based or template-based cross-correlation techniques, the addition of low-level spectral contamination introduces systematic noise into the veloc- ity measurements. The NEID (NN-EXPLORE Exoplanet Investigations with Doppler spectroscopy) pre- cision RV instrument for the WIYN (Wisconsin-Indiana-Yale-NOIRLab) 3.5 m telescope serves as an ongoing resource for the community to explore and evaluate correction tech- niques. For these next-generation instruments to achieve 10 cm s −1 precision on the most interesting exoplanet systems, dark skies may be required, even though “bright time” has traditionally sufficed for RV science. Dr. Arpita Roy at STScI had worked on the simula- tions to minimize solar contamination’s impact to very low levels before the NEID spectro- graph started taking data. I worked on radial velocity data taken by the NEID Spectrograph to estimate the range of RV measurement error induced by scattered sunlight contamination as compared to the predictions in [Roy 20]. I demonstrate the effectiveness of different correction techniques, using simultaneous spectrometer sky fibers that are expected to reduce this source of error to below the photon-noise limit of typical stellar observations. I worked to verify the as- sumptions of the previously done simulations and checked for any further corrections or the addition of more factors in the mitigation process. I also plan to work on it further using coherent fiber bundles (CFBs) and we plan to publish the follow-up paper to ([Roy 20]) and provide definitive guidance to the exoplanet community on the precision achievable in a range of sky brightness conditions.
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