A Thesis to Probe Unique Exoplanet Regimes with MicroArcsecond Astrometry and Precision Closure Phases at CHARA and VLTI

Tyler Gardner, John D. Monnier, Francis C. Fekel, Jean-Baptiste Le Bouquin, Adam Scovera, Gail Schaefer, Stefan Kraus, Fred C. Adams, Narsireddy Anugu, Hayley Beltz, Jean-Philippe Berger, Theo ten Brummelaar, Claire L. Davies, Jacob Ennis, Douglas R. Gies, Keith J. C. Johnson, Pierre Kervella, Kaitlin M. Kratter, Aaron Labdon, Cyprien Lanthermann, Isaac Malsky, Emily Rauscher, Johannes Sahlmann, Benjamin R. Setterholm

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In this thesis work, we exploit the unique capabilities of long baseline interferometry to fill two gaps in exoplanet parameter space: 1) the discovery of new planets around stars more massive than the Sun (Project ARMADA), and 2) the characterization of known planets that are extremely close to their host star (Project PRIME). Current detection methods struggle to find exoplanets around hot (A/B-type) stars. We are pushing the astrometric limits of ground-based optical interferometers to carry out a survey of sub-arcsecond A/B-type binary systems with ARMADA. We are achieving astrometric precision at the few tens of micro-arcsecond level in short observations at CHARA/MIRC-X and VLTI/GRAVITY. This incredible precision allows us to probe the au-regime for giant planets orbiting individual stars of the binary system. We present the status of our survey, including our newly implemented etalon wavelength calibration method at CHARA, detection of new stellar mass companions, and non-detection limits down to a few Jupiter masses in some cases. With Project PRIME, we show that ground-based optical interferometry can be used to measure the orbit-dependent spectra of close-in "hot Jupiter"-type exoplanets with precision closure phases. Detecting the infrared spectra of such planets allows us to place useful constraints on atmosphere circulation models. We perform injection tests with MIRC-X and MYSTIC at CHARA for the hot Jupiter exoplanet Ups And b to show that we are reaching down to a contrast of 2e-4. The promise of both these methods demonstrate that optical interferometers are a valuable tool for probing unique regimes of exoplanet science.