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Measuring high accuracy high resolution stellar template spectra with dispersed interferometry

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High resolution broad-band spectroscopy at near-infrared wavelengths has been performed using externally dispersed interferometry (EDI) at the Hale telescope at Mt. Palomar. The EDI technique uses a field-widened Michelson interferometer in series with a dispersive spectrograph, and in so doing, a spectrum with a resolution 4 to 10 times higher than the existing grating spectrograph has been recovered. This method increases the resolution well beyond the classical limits enforced by the slit width and the detector pixel Nyquist limit and, in-principle, decreases the effect of pupil variation on the instrument line-shape function. The EDI technique permits arbitrarily higher resolution measurements using the higher throughput, lower weight, size, and expense of a lower resolution spectrograph. Observations of many stars were performed with the TEDI interferometer mounted within the central hole of the 200" primary mirror. Light from the interferometer is then dispersed by the TripleSpec near-infrared echelle spectrograph. Continuous spectra between 950 and 2450 nm with a resolution as high as ~27,000 were recovered from data taken with TripleSpec at a native resolution of ~2700. Aspects of data analysis for interferometric spectral reconstruction are discussed, and the resulting spectra of different stars are characterized and compared to previous measurements. Application to improve measurements of high-resolution stellar template spectra, critical for precision Doppler velocimetry using conventional spectroscopic methods, is discussed. A new interferometer to be applied for this purpose at visible wavelengths is under construction. This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.