A comprehensive comparative exoplanetology program to probe atmospheric properties of close-in giant exoplanets

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We present a comparative exoplanetology program of a broad sample of transiting gas giant exoplanet atmospheres using a multi-wavelength ground-based survey. The survey comprises optical and near-infrared spectrophotometric observations with Gemini/GMOS and Keck/MOSFIRE respectively. By observing transits and eclipses of an ensemble of close-in gas giants spanning a range of varying bulk and stellar host properties, and using a consistent methodology for modeling systematics and stellar activity, we put constraints on the presence and properties of clouds, alkali metals, and molecular absorbers in their atmospheres. Combining these results with observations from other observatories (TESS, HST, and Spitzer), we probe the overall properties of close-in giant exoplanet atmospheres, including their metallicity, using multiple tracers across the wide wavelength range. Characterizing the bulk chemical and physical properties of the whole sample helps to constrain the formation and evolution histories of these planets. We also discuss the opportunities of low-resolution spectroscopy observations of exoplanet atmospheres in the JWST era.