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Observing Solar Plasma Environments with DKIST

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The Sun displays diverse plasma environments structured by magnetic fields. The largely neutral photosphere is sprinkled with $\sim$1 kG magnetic fields rooted in the underlying convection zone. Just above this magneto-acoustic shocks and rapidly expanding magnetic fields create complex and dynamic structures interspersed with quiescent and eruptive phenomena in the chromosphere. The average temperature increases through the chromosphere abruptly jumps to $> 10^6$ K in the solar corona. These different regimes are directly coupled by many processes that have been extensively studied using a combination of theory, simulations, and laboratory experiments: dynamos, waves, instabilities, and reconnection. The National Science Foundations Daniel K. Inouye Solar Telescope is an unprecedented new facility that will allow for measurements of the highest spatial resolution and superb signal to noise on shorter timescales than ever before. First light instruments will provide simultaneous multi-wavelength observations with spectral and polarimetric capabilities on disk and above the limb. Coupled with radiative MHD modeling, this can provide 3D diagnosis of plasma parameters (e.g. magnetic field vector, temperature) over the plasma regimes found throughout the Suns atmosphere.