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New diagnostic facilities for Caltech plasma experiments[1] XIANG ZHAI, PAUL BELLAN, Caltech — An optically coupled high voltage probe (HV probe) and a visible and near infrared (VNIR) detector are being developed for Caltech solar coronal loop and astrophysical jet experiments. The HV probe uses a capacitive voltage divider coupled a fast LED to convert the electrical signal into an optical signal, which is then conveyed to a receiver via an optical fiber. A solar cell array powered by ambient laboratory lighting charges a capacitor that when triggered acts as a short-duration power supply for an onboard amplifier in the HV probe. The fast VNIR detector combined with specific atomic line filters measures the spectra with 10ns time resolution. Measurements show that before detachment, the gross VNIR emission power of the solar coronal plasma loop is a function of the axial electric current. Hα and Hβ line emission power is found to be $10^2 \sim 10^3$ greater than predicted by assuming local thermodynamic equilibrium. This indicates that the plasma is not in an ionization-recombination equilibrium state and can have a larger population of neutrals than predicted for an equilibrium state.

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