Contributed Talk

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Doppler Spectroscopy of the Solar Corona: Detection of Cool Prominence Material Embedded in a Hot Fe XIV Plasma Environment within a Fast Moving CME-Front

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Multi-wavelength eclipse observations of the coronal forbidden lines, namely Fe IX, X, XI, XIII and XIV, have shown how minor ions offer unique plasma diagnostics in the inner corona, starting from the solar surface out to several solar radii. These are currently untenable from any other platform or instruments. One of the advantages of these spectral lines is the radial extent of their emission that surpasses that of the ultraviolet. It is this radial coverage and the excitation properties of these lines, dominated by resonance very close to the Sun, which provides a unique tool for exploring the most critical region of the corona, namely the acceleration region of the solar wind. This is where the changes in the plasma properties and magnetic fields are the most pronounced. Coronal mass ejections (CMEs) are the largest and most dynamic explosions detected in the million degree hot Solar corona, with speeds reaching up to 3000 $km.s^{-1}$ at Earth's orbit. Triggered by the eruption of prominences, in most cases, one of the outstanding questions pertaining to the dynamic CME-prominence system is the fate of the cool ejected filaments. We present spectroscopic observations acquired during the 20. March 2015 total solar eclipse, which captured a plethora of red-shifted plasmoids from Fe XIV emission at approx. 2 x $10^6 K$. Approximately 10% of these plasmoids enshrouded the neutral and singly ionized plasma below 2 x $10^5 K$, also observed in prominences anchored at the Sun at that time. This discovery was enabled by the novel design of a dual-channel spectrometer and the exceptionally clear sky conditions on the island of Svalbard during totality. The Doppler red-shifts corresponded to speeds ranging from under 100 to over 1500

$km.s^{-1}$. These are the first comprehensive spectroscopic observations to unambiguously detect a 2 x $10^6 K$ hot filamentary CME front with inclusions of cool prominence material. The CME front covered a projected area of 2.5x1.5 R_s^2 starting from the solar surface.