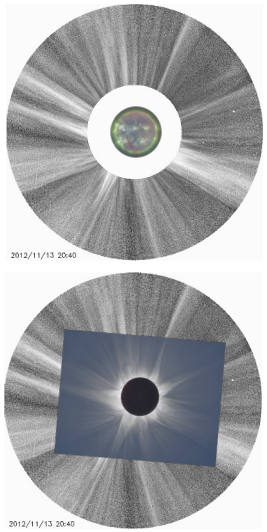
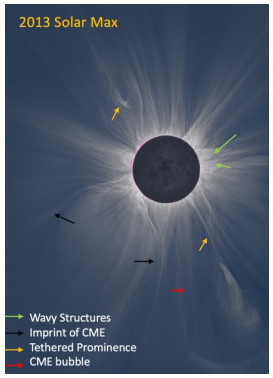
Total solar eclipse observations: Filling a critical science gap for identifying the sources of the solar wind

S. R. Habbal (habbal@hawaii.edu, IfA), B. Boe (IfA), M. Druckmuller (Brno U. Technology), A. Ding (ITP), N. Alzate (USRA)

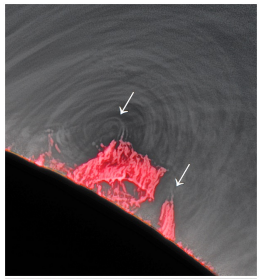
Links in the critical science gap



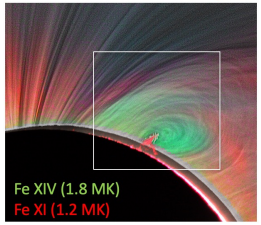


Preponderance of turbulence, waves and instabilities in the low corona, invariably present in the immediate environment of prominences, manifested in-situ as waves, turbulent structures, low ionized ions & neutrals

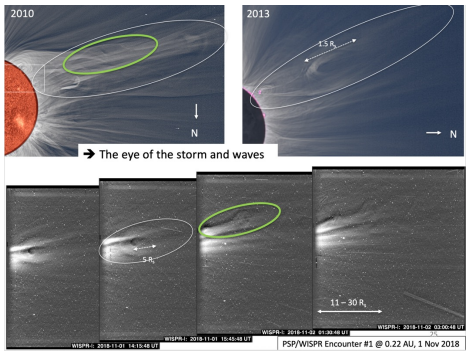
Prominence-corona connectivity

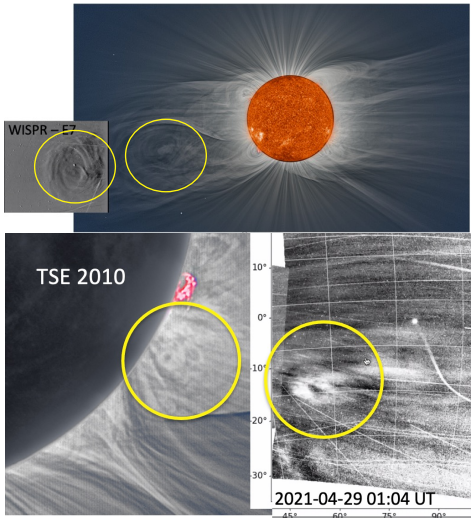


Hot prominence shroud

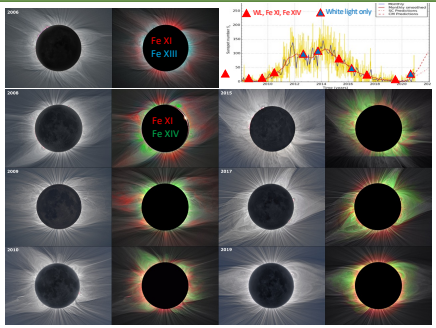


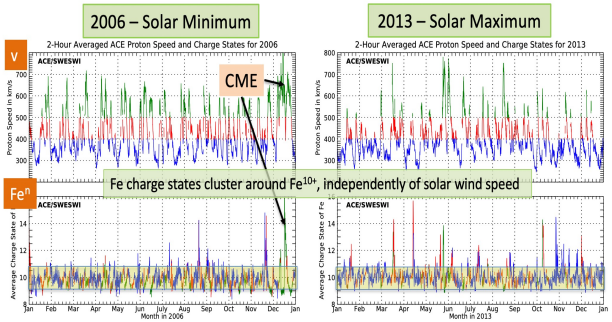
Complexity of CMEs, and origin of waves & turbulent structures in-situ (comparison w/ WISPR)





Multi-wavelength eclipse observations of Fe XI (Fe^{10+}) & Fe XIV (Fe^{13+}) combined with Fe^{10+}, Fe^{13+} in situ charge states, straddling 2 solar cycles: 2006 – 2020





- Ubiquitous Fe XI (Fe^{10+}) emission a at 1.2 MK from open field lines not limited to CHs & independent of phase within a solar cycle
- T_e at the source of open field lines constrained to 1.2 MK

- Fe^{10+} freezes-in around 1.4 R_s
- Fe^{10+} ions (= Fe XI coronal emission in the corona) are the dominant charge state in the steady solar wind independently of wind speed
- High charge states associated with CMEs

Summary: Insights from Total Solar Eclipse Observations