The plume vs interplume dilemma

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Coronal Holes & Fast Wind

Coronal holes are known to be the sources of the fast wind.

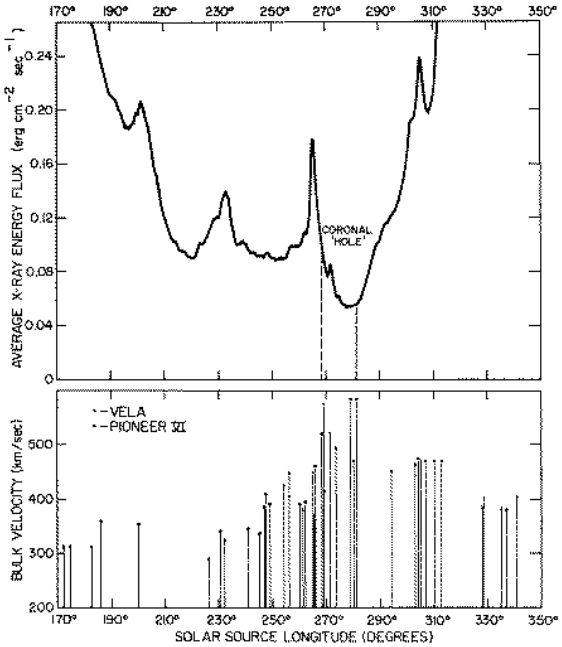
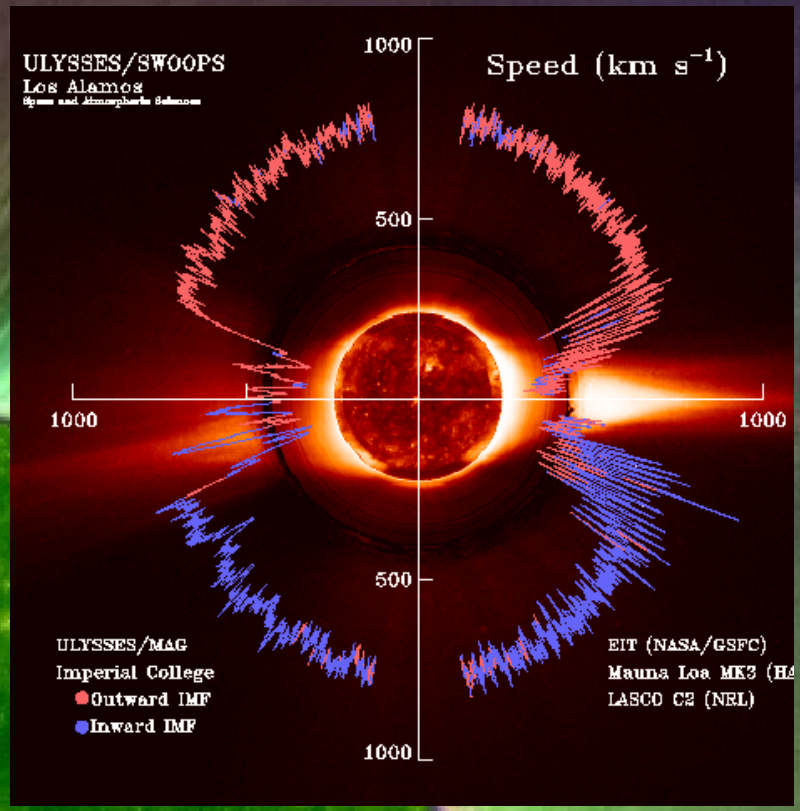


Fig. 7. Comparison of (a) the intensity in the wavebands 3–35 Å and 44–51 Å emitted from an equatorial swath extending 4′ in latitude and with a 4° longitudinal sampling interval, and (b) the solar wind bulk velocity measured from Pioneer VI and Vela. (Pioneer VI data courtesy of A. J. Lazarus, Vela data from the *NOAA, ERL Reports of Solar-Geophysical Data*, No. 316, Part I, 1970).

Krieger et al. 1973

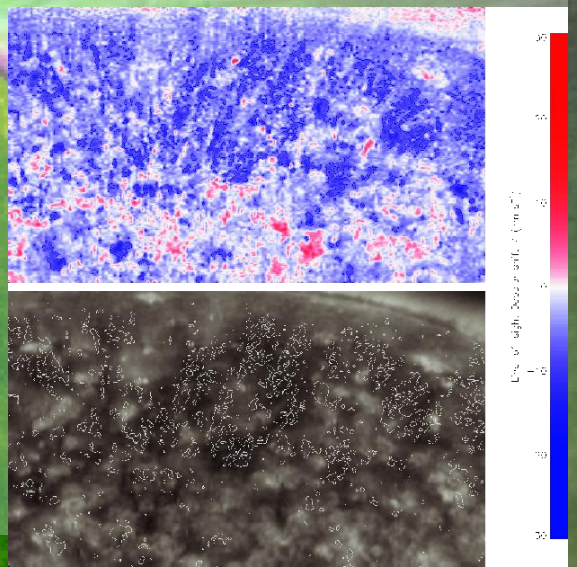


Woch et al. 1997
McComas et al. 2000

Plumes or Interplumes?

Being the most prominent feature within CHs, plumes have been and are considered as a strong candidate for the source regions of the fast wind. However:

- Abundance comparisons between the two regions and the fast wind proved inconclusive (Young et al. 1999; Wilhelm 1998; Del Zanna et al. 2003; Doschek et al. 1998).
- Broader line profiles in interplumes (e.g., Banerjee et al. 2000, Giordano et al. 2000, Teriaca et al. 2003) may indicate more heating of these regions.
- On the disk, larger shifts are observed in regions of weak Ne VIII (0.6 MK) emission (e.g., Wilhelm et al. 2000).
- In general, larger shifts are observed in interplumes at the base of the corona.

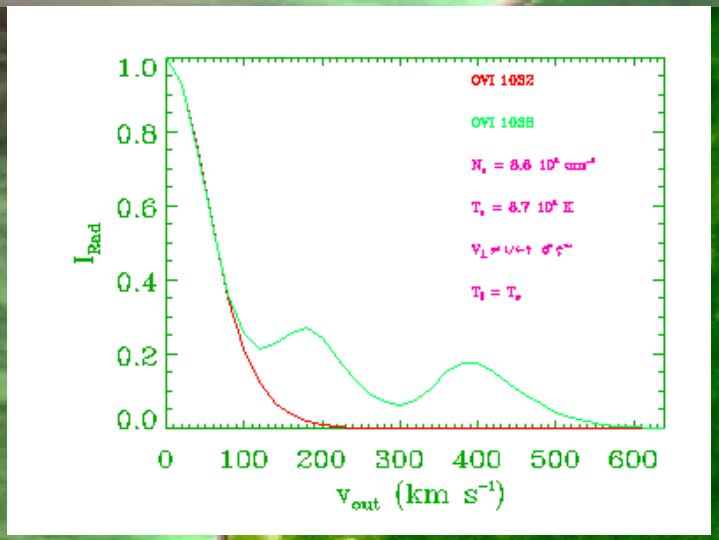


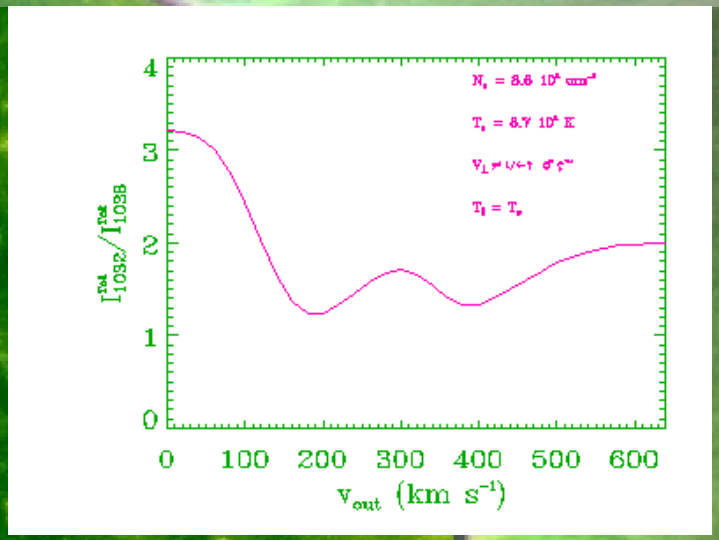
Doppler Dimming

- Electron impact excitation (collisional component).
- $I_{coll} = 0.85\ (\Delta E_{gu}/4\pi) A_{O/H} \langle q(T_e) R(T_e)\ N_e^2 \rangle$
- Resonant absorption of disk radiation (radiative component).
- $I_{rad} = 0.85 (\Delta E_{gu}/4\ \pi) A_{O/H}\ B_{gu} I_{Sun} \langle D(W,T_0) R(T_e)\ N_e \rangle$
- $D(W,T_0)$ accounts for Doppler dimming and geometrical dilution factors. It is function of the ion temperature (consisting of the components perpendicular $T_\perp$ and parallel $T_\parallel$ to the magnetic field).

O VI 103.2/103.7 (Kohl & Withbroe 1982; Noci et al. 1987)**:**

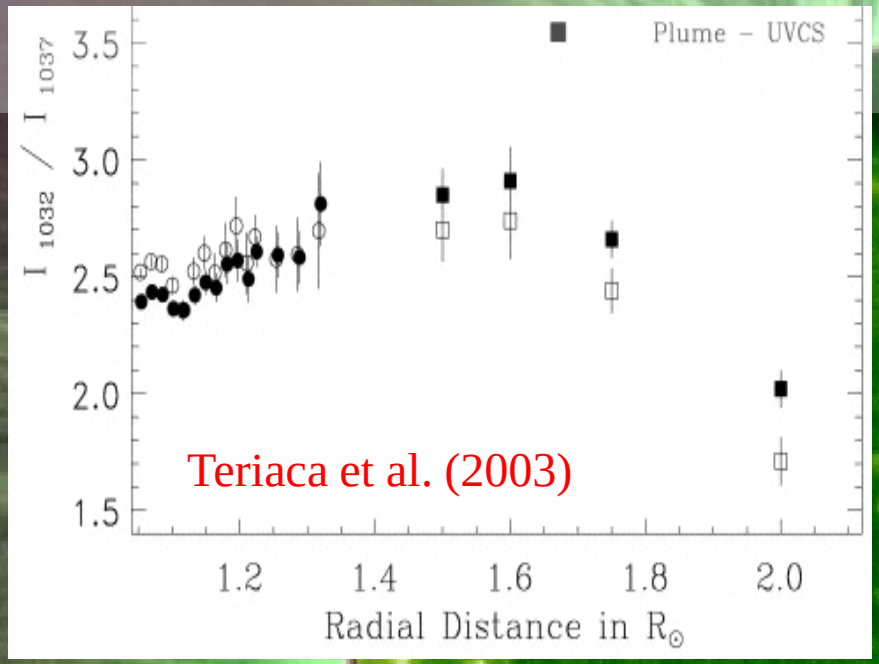
Mainly a function of N_e and W.



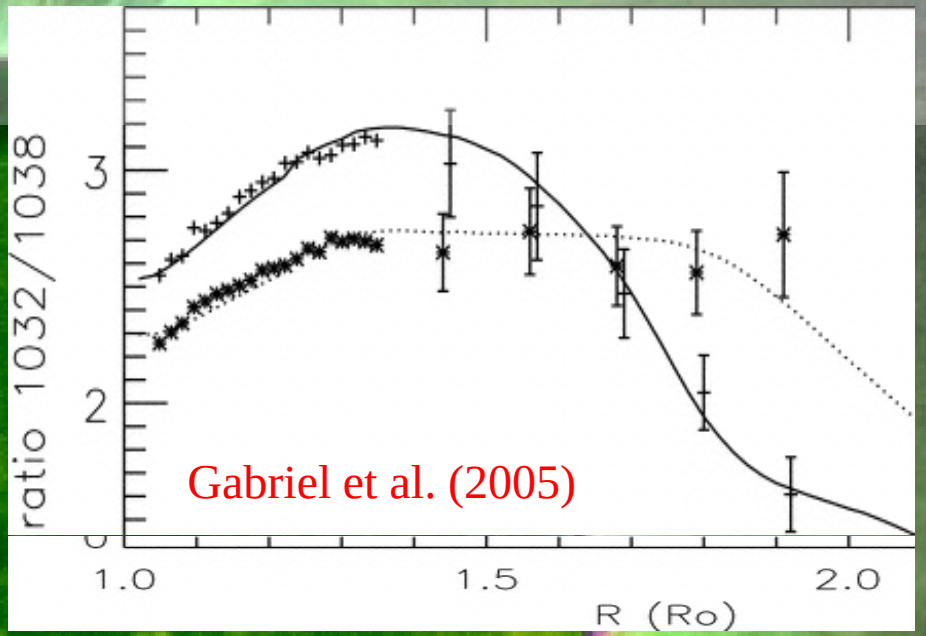


What are plumes doing?

- From SUMER data Gabriel et al. (2003) and Teriaca et al. (2003) derived velocities in plumes and interplumes below 1.5 Solar radii.
- Measured line ratios are similar and the resulting interplume outflow speed profile is comparable. However, Gabriel et al. predict outflows to be larger in plumes than in interplumes by a factor ≥ 2, with a velocity ≥ 70 km s^{-1} around 1.05 solar radii (against small or zero velocities of Teriaca et al.).



Teriaca et al. (2003)



Gabriel et al. (2005)

Final notes

This “controversy” spurred a lot of very interesting and constructive discussions culminated in the AOGS Plume Section and the ISSI Workshop (see here a picture of a special session of it).

For the future:

More observations with next generation spectrographs (SPICE, LEMUR/EUVST).

Particularly important would be to have:

- Higher sensitivity (temporal resolution).
- Simultaneous acquisition of all needed information (e.g., electron densities and temperatures, disk radiance distributions).
- Better stray light performances.