AOGS 2005

Polar Plumes in white light

SERGE KOUTCHMY[1] and PHILIPPE LAMY[2]
[1]*Institut d'Astrophysique de Paris , 98 Bis Bd Arago F-75014 Paris (France)*
[2]*Laboratoire d'Astronomie Spatiale, BP8-13376 Marseille Cedex 12 (France)*

We review present evidences and understanding of coronal polar flumes as seen in white light, on the basis of eclipse and space-coronagraphs observations, essentially LASCO-C2 and C3. The lower part of polar flumes is best studied on high resolution eclipse images and they reveal specific features such as quasi-radial dark lanes or rifts, interpreted as regions of very low electron densities, sometimes called emptiness, reminding dark cavities observed at lower latitudes. Accurate absolute photometry of eclipses images allowed quantifying both the average and the local densities by inverting the line-of-sight integrated brightness assuming some three-dimensional geometry of the plumes, based on their idealized appearance assumed to be constant in time. From the radial gradients of densities, rather low hydrostatic temperatures have been deduced. However the difficulty of defining a definite cross-section of polar plumes makes it impossible to propose a quasi stationary hydro dynamical model along the radial direction. This suggests the influence of parameters related to their dynamical behavior, with possibly two co-existing components with different plasma betas. The connections of polar plumes with i) the chromospheric network and the off-limb spikes and ii) the overlapping structures due to projection effects of the edges of sheet streamers or even fine stalks of streamers have been considered to explain their origin. There are some evidences that polar flumes are more likely localized at the edges of coronal holes. The outer part of the plumes is best studied on LASCO-C2 and C3 images and in fact they can be traced to 30 solar radii, the outer edge of the C3 coronagraph. Observations taken at high temporal resolution revealed that plumes are episodic in nature, lasting perhaps 24 hr but recurring for up to weeks at a time. This intermittent pattern of plume lifetime supports the theory that magnetic reconnection in the supergranular network lanes is probably responsible for plume formation. Expansion velocities in plumes have been measured on LASCO-C2 images and the distribution ranges from 200 to 1000 km/sec with a mean value of 460 km/sec.

References

[1] DeForest, C.E. Lamy, P.L. and Llebaria, A. 2001, ApJ 560, 490
[2] Koutchmy, S. and Bocchialini, K. 1998, "White-light polar plumes from solar eclipses", in "Solar Jets and Coronal Plumes", ESA SP-421, 51.
[3] Koutchmy, S. and Loucif, M.L. 1990, "Properties of Impusive Events in a Coronal Hole", in "Mechanisms of Chromopsheric and Coronal Heating", Proceedings of the Intern. Conf. Heidelberg, Ulmschneider, Priest and Rosner Ed. Springer-Verlag.