PTYS544

Physics of the High Atmosphere

Basic details

- Location / Time
  - Tuesday & Thursday, 12:30 – 13:45
  - Kuiper Space Science (KSS)
- Instructor
  - Tommi Koskinen, KSS 421
  - tommik@email.arizona.edu

The origin of the solar wind

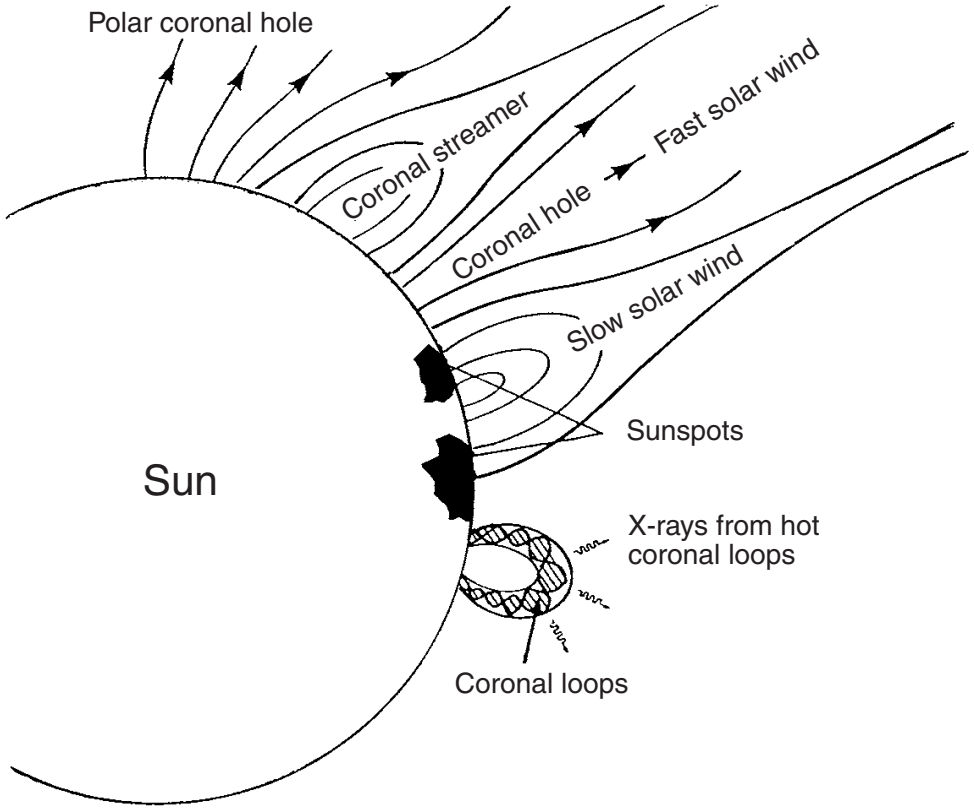
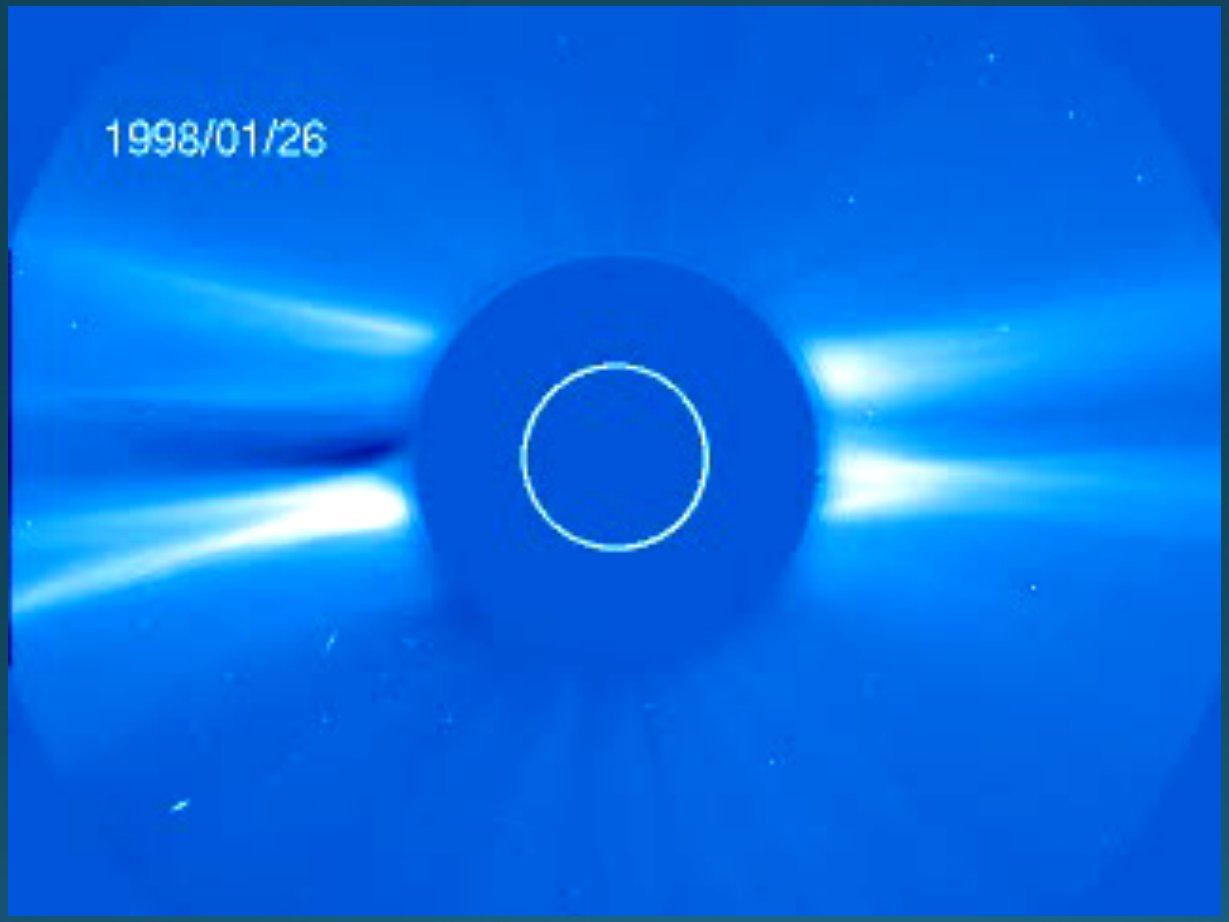
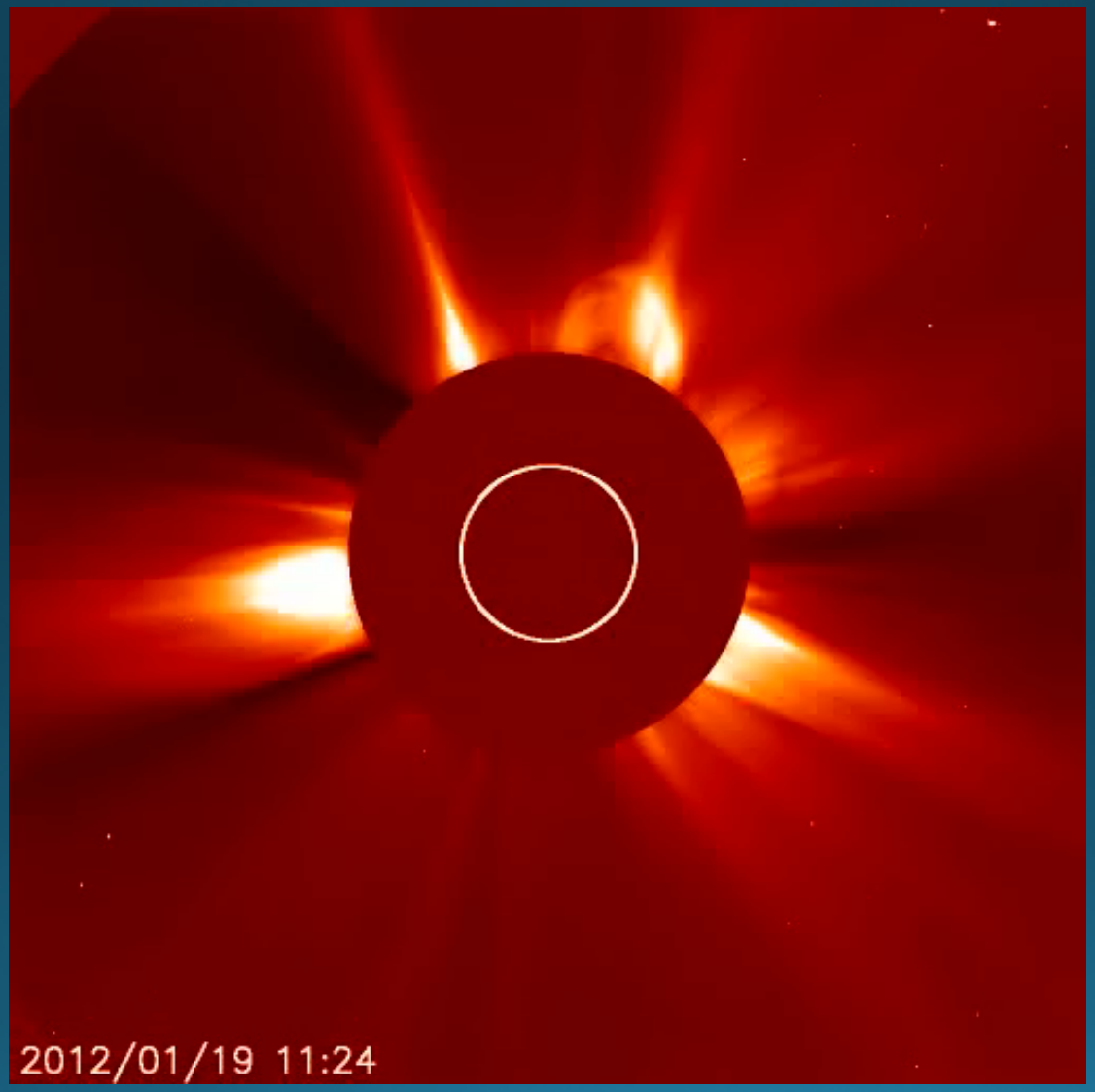


Figure 2.2 Schematic diagram of the magnetic field topology in the solar corona and the associated coronal features. The solid curves with arrows are the magnetic field lines.[2]

Schunk and Nagy (2000)


1998/01/26

CME (January 2012)



Parker spiral

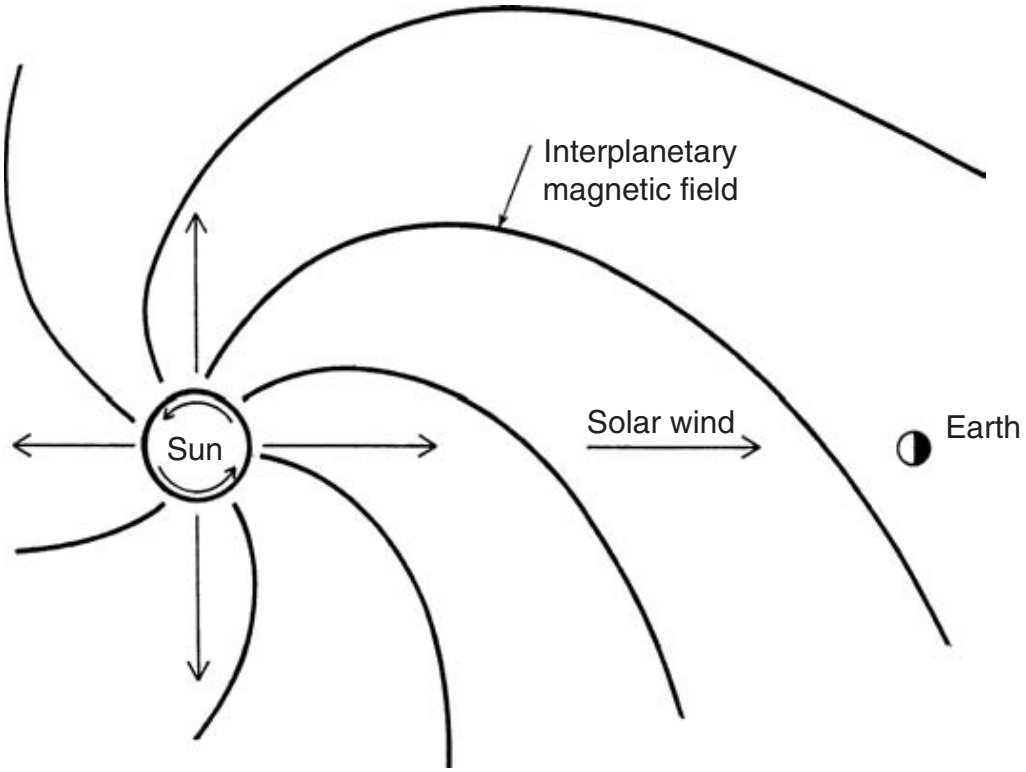


Figure 2.6 Schematic diagram of the Sun–Earth system in the Sun's ecliptic plane. The solar wind is in the radial direction away from the Sun and the magnetic field lines bend into spirals as the Sun slowly rotates.

Ballerina skirt

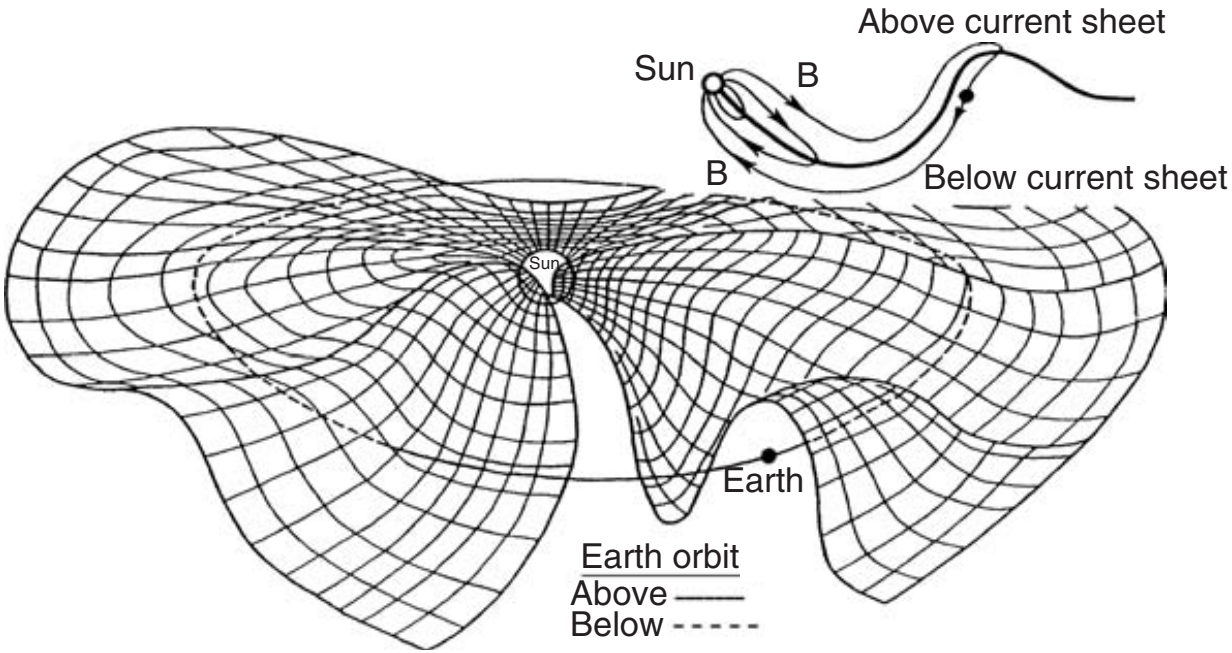
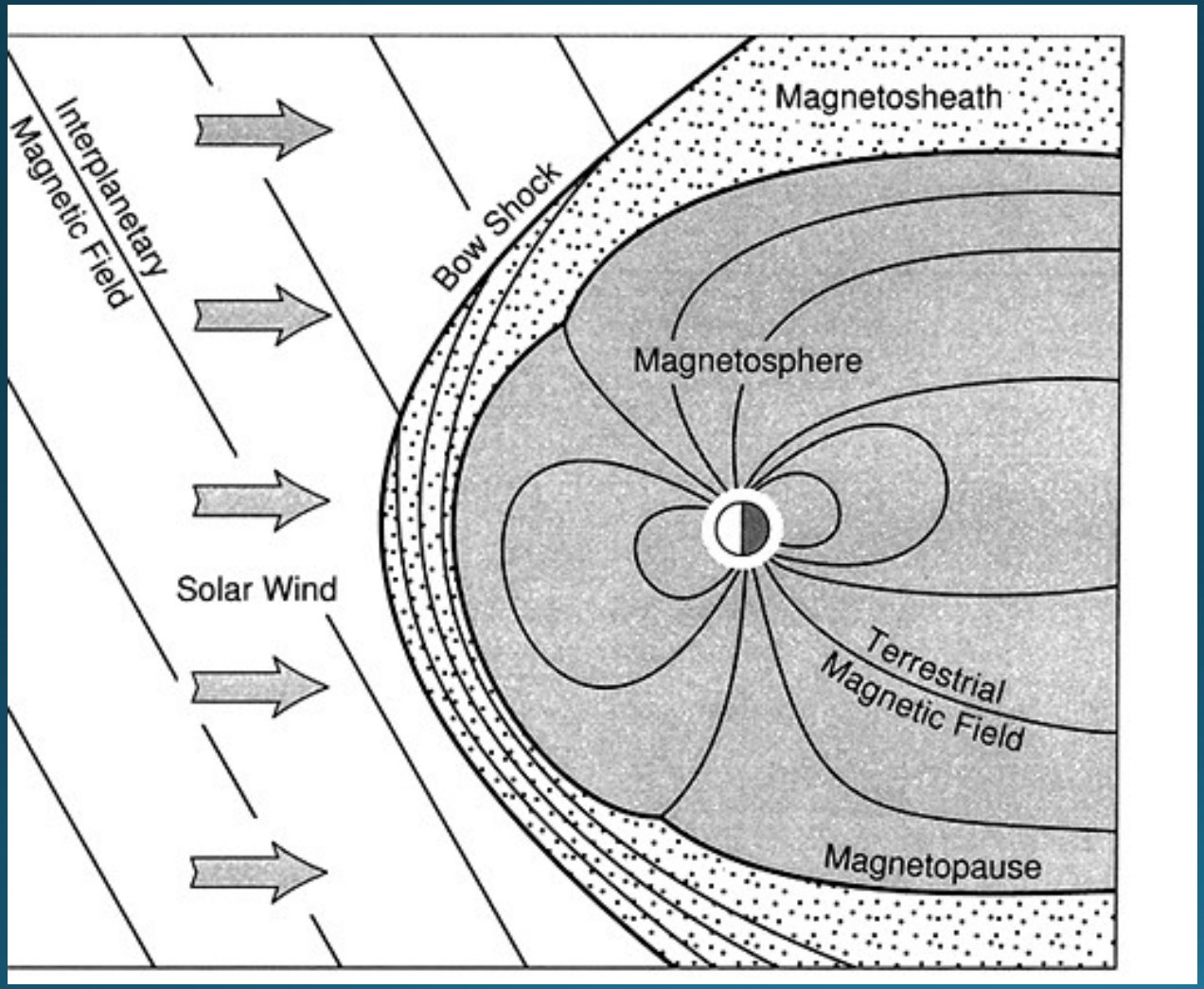


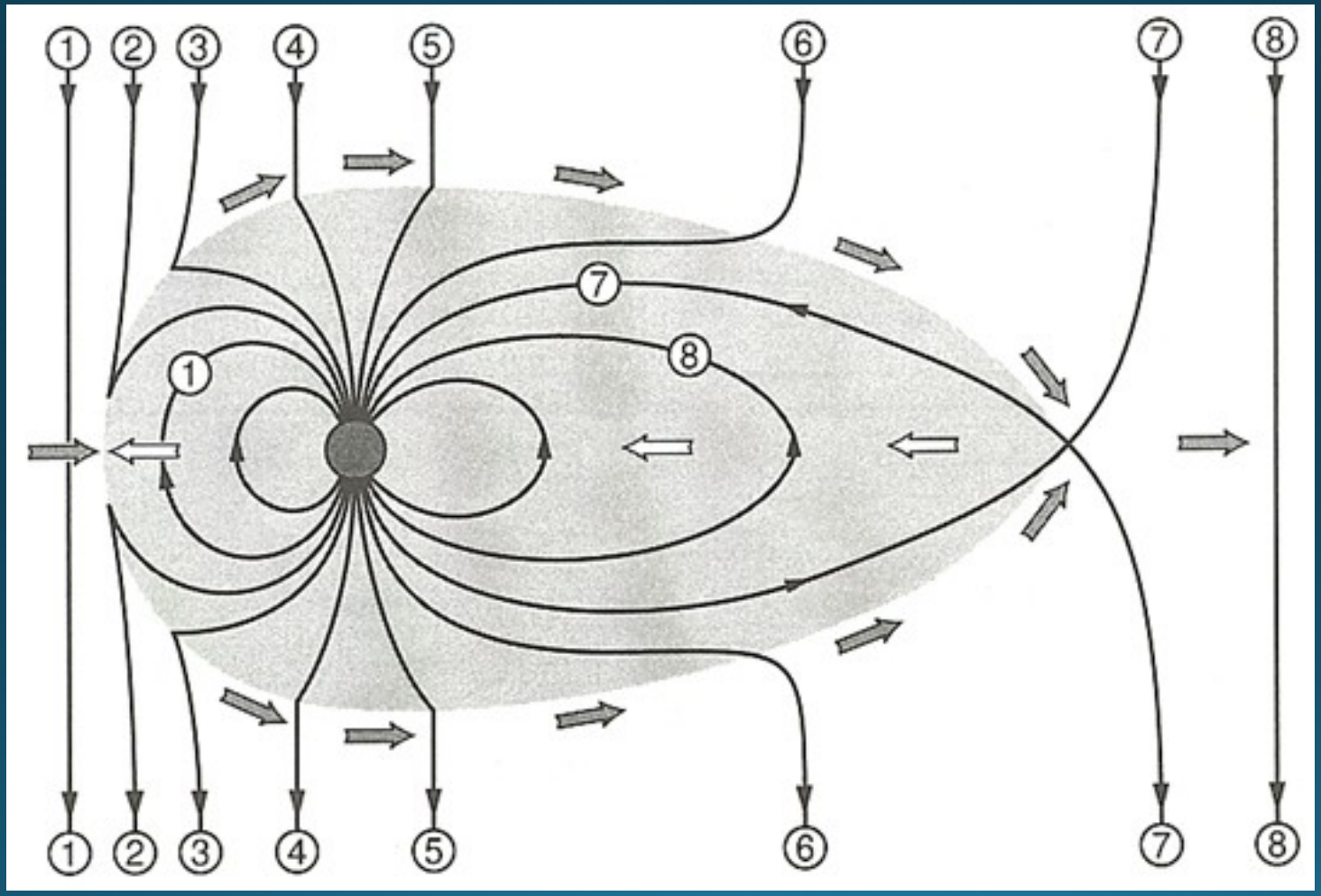
Figure 2.7 Schematic diagram of the three-dimensional structure of the current sheet that flows in an azimuthal direction around the Sun. The inset at the top of the figure shows the opposite polarities of the magnetic fields on the two sides of the current sheet.[9] (Courtesy of S.-I. Akasofu, Geophysical Institute, University of Alaska).

Structure of the terrestrial magnetosphere



North

Merging and reconnection



View from the tail

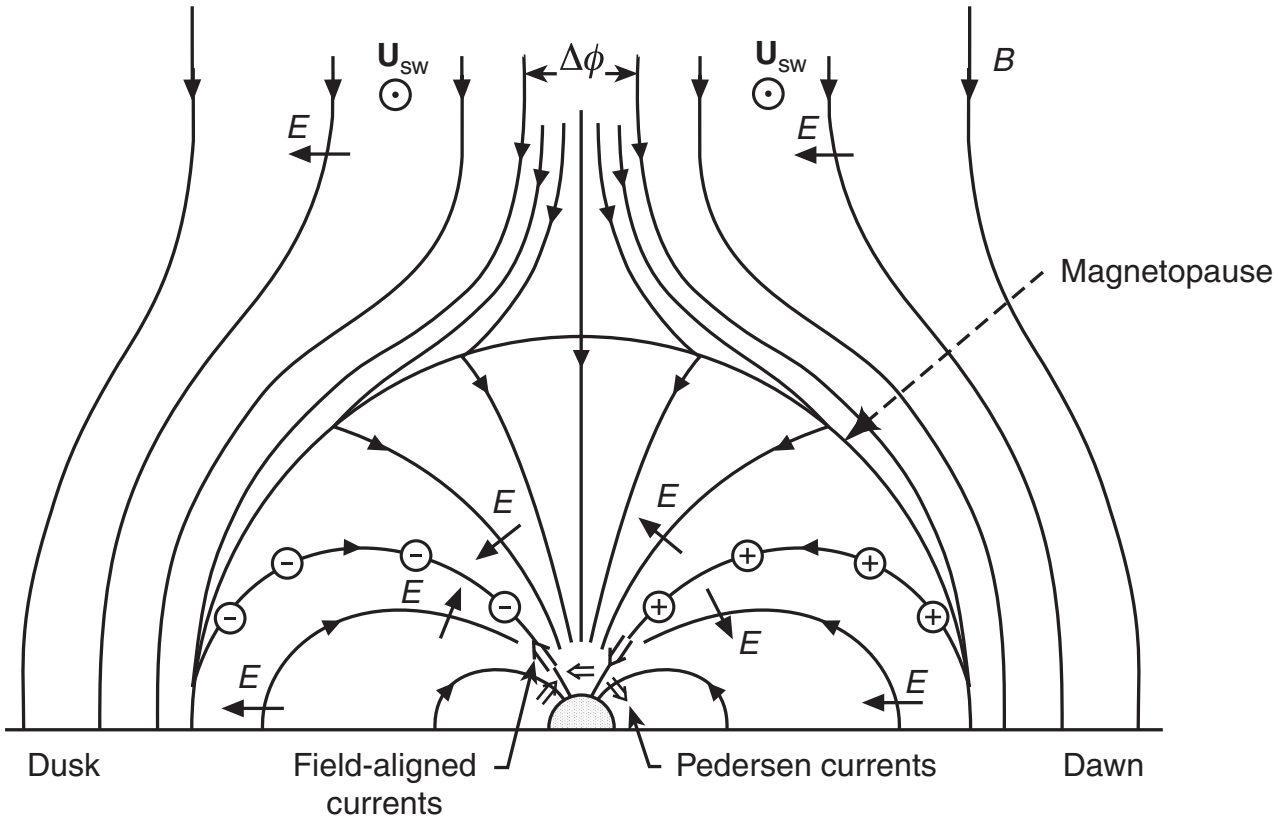


Figure 12.3 Schematic diagram showing the electric and magnetic fields in the vicinity of the Earth. The view is from the magnetotail looking toward the Sun. The solar wind is toward the observer and north is at the top.[1]

Auroral electric potential

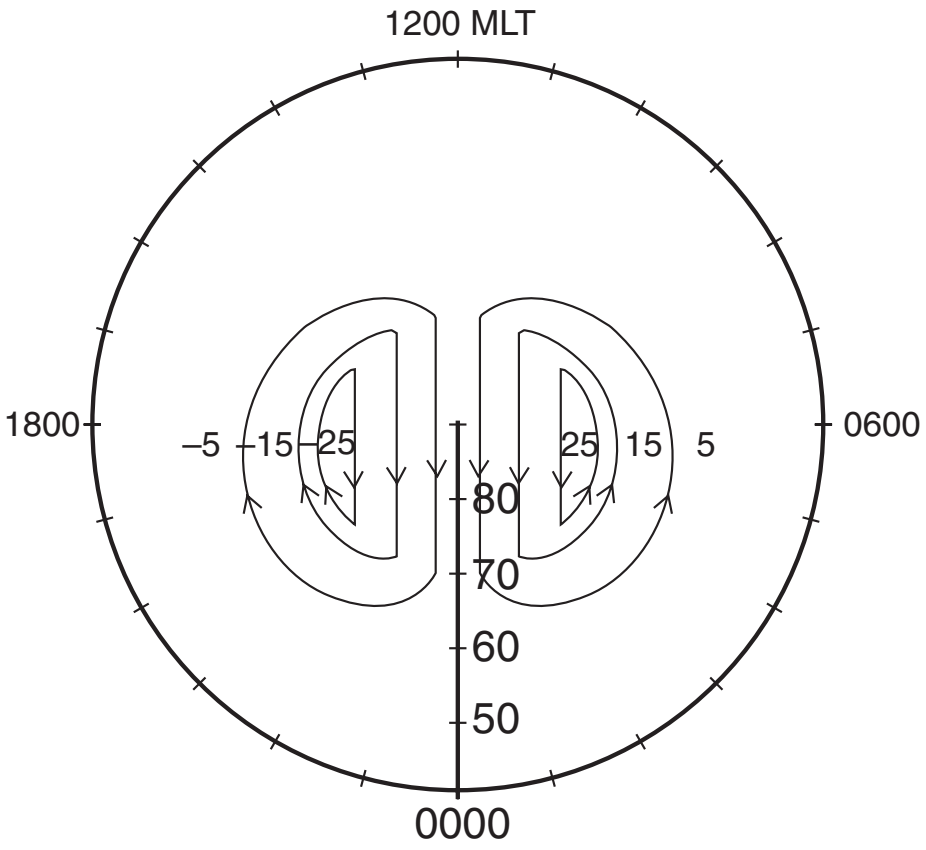
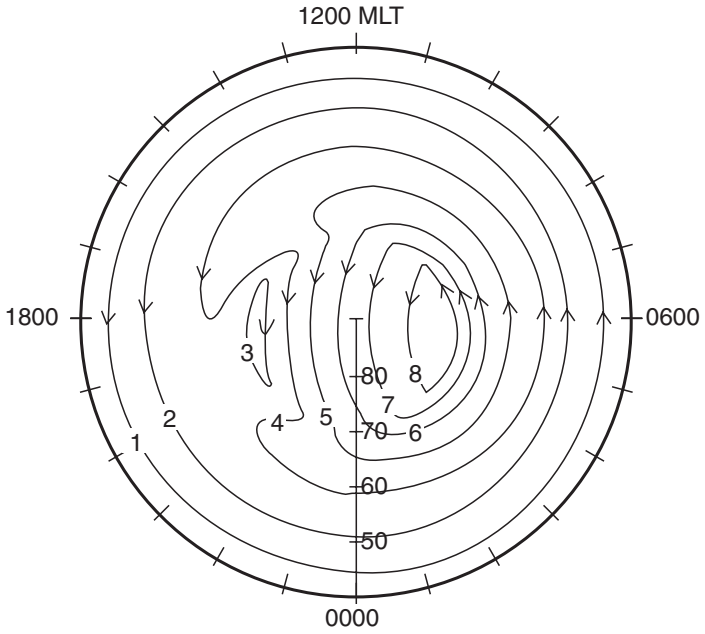


Figure 12.4 Contours of the magnetospheric electrostatic potential in a magnetic latitude-MLT reference frame. The contours display a symmetric two-cell pattern of the Volland-type.[2] The total potential drop is 64 kV. Courtesy of M.D. Bowline.

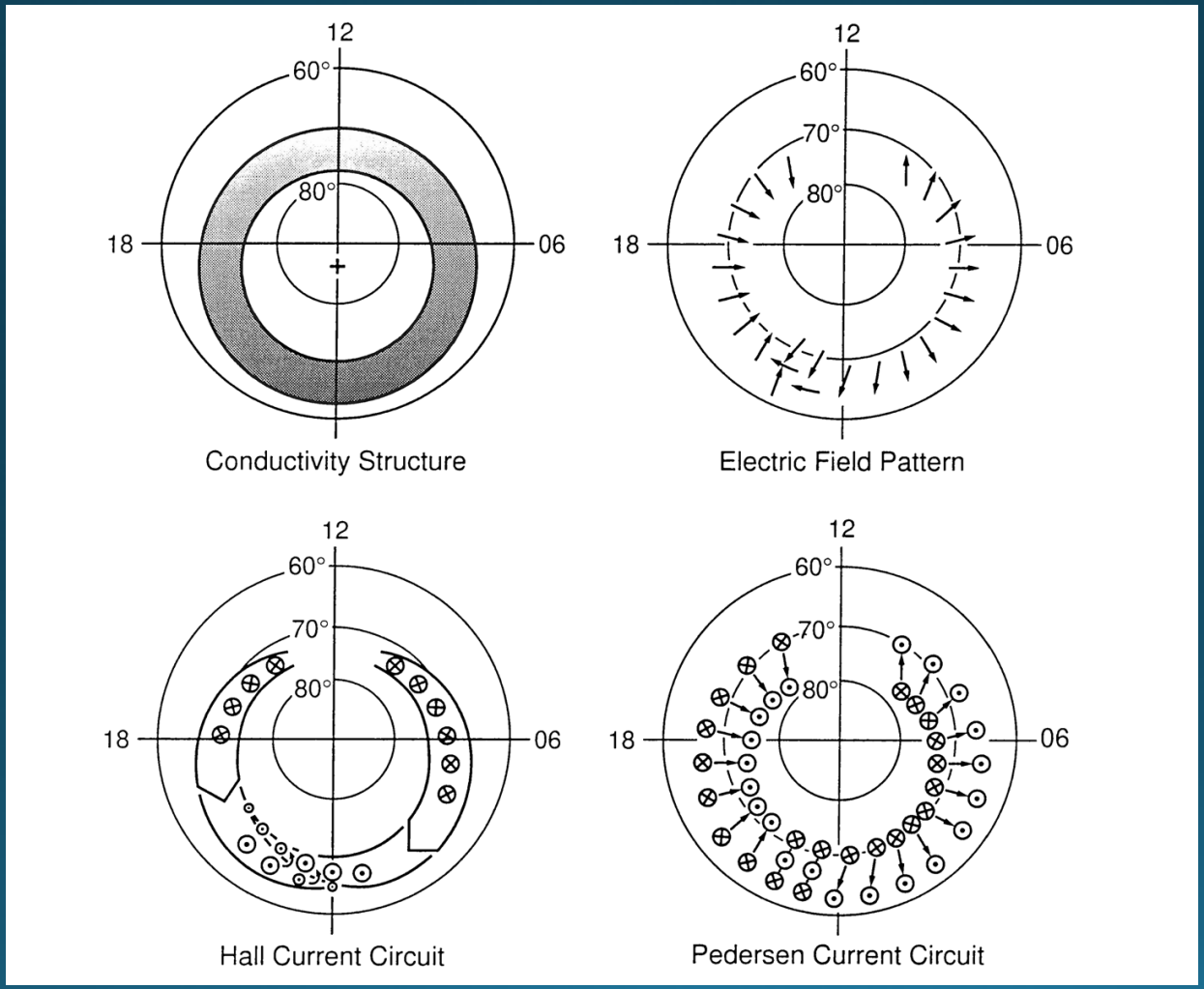
Potential with co-rotation



Label	1	2	3	4	5	6	7	8
Circulation period (day)	1.00	1.01	0.10	1.34	0.50	0.31	0.18	0.11

Figure 12.5 Plasma drift trajectories in the polar region viewed in a magnetic quasi-inertial frame. These trajectories are for a symmetric two-cell convection pattern with co-rotation added. The potential drop across the polar cap is 64 kV, and the circulation periods are tabulated at the bottom.[3]

Field-aligned currents



Auroral oval

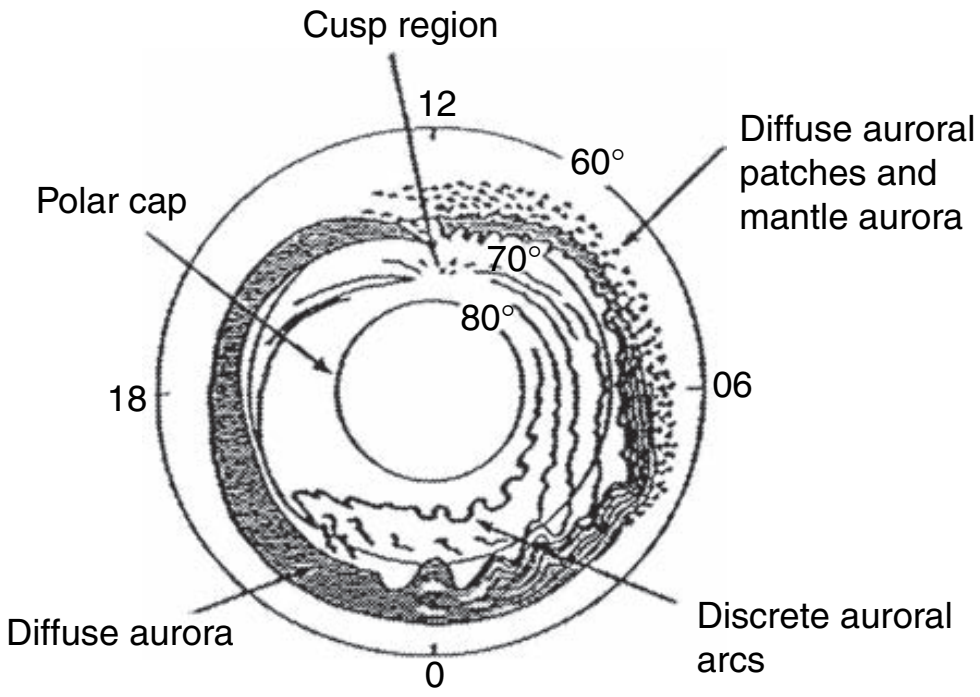
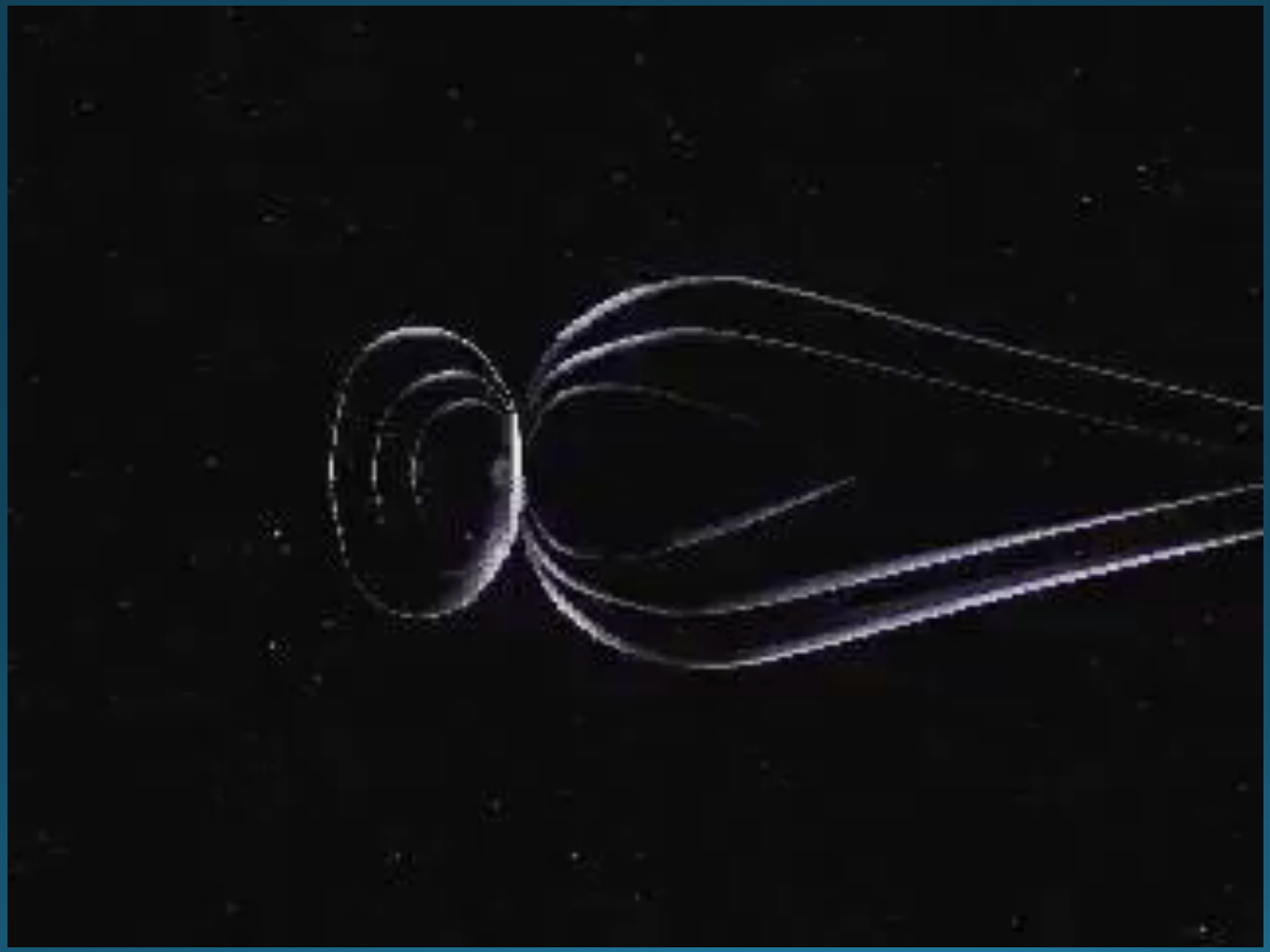
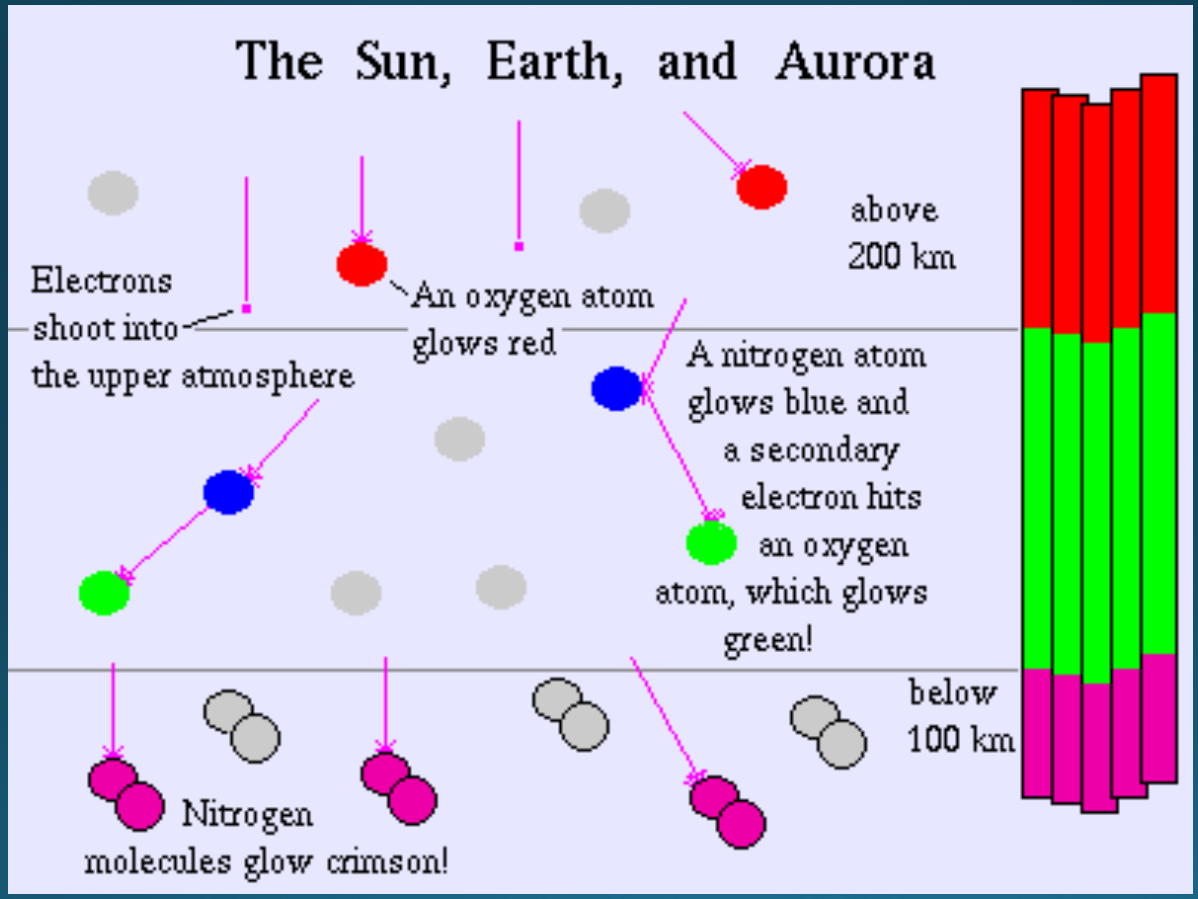


Figure 12.22 Schematic diagram showing the different particle precipitation regions in the auroral oval for southward IMF.[23]

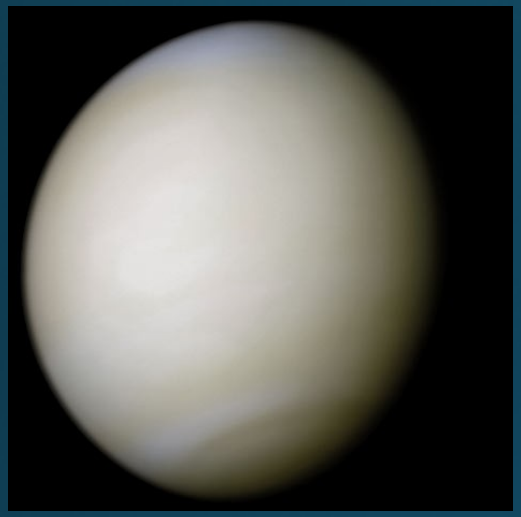
Solar wind-Earth magnetic field interactions



Aurora at different altitudes



Venus



Images of dayglow and nightside aurorae on Venus emitted by oxygen at UV wavelengths based on data from Pioneer Venus Orbiter (below, Phillips et al. 1986)

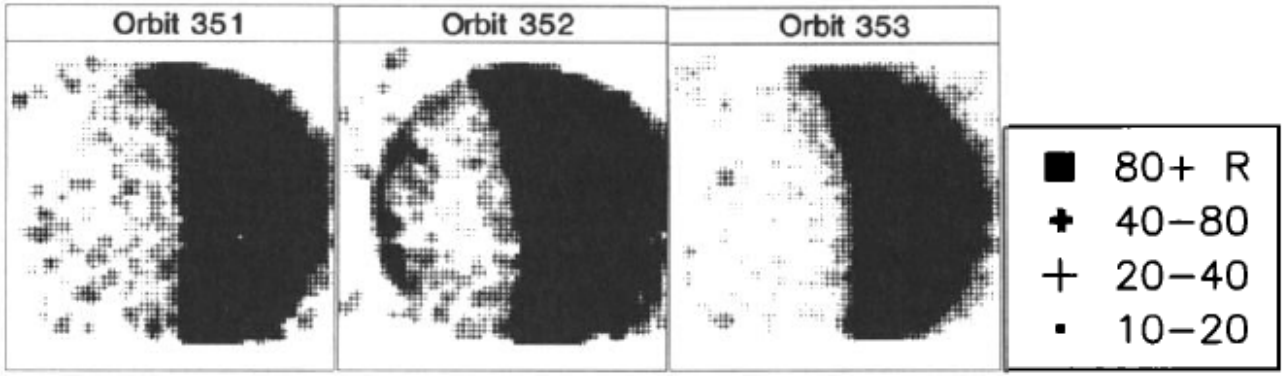
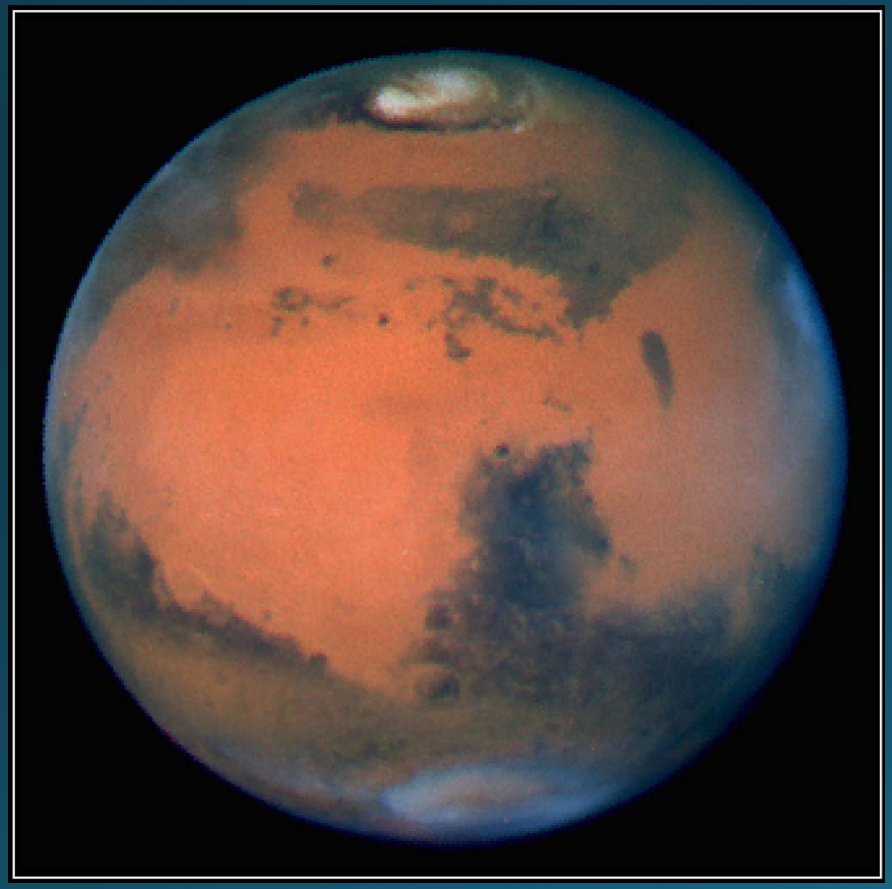
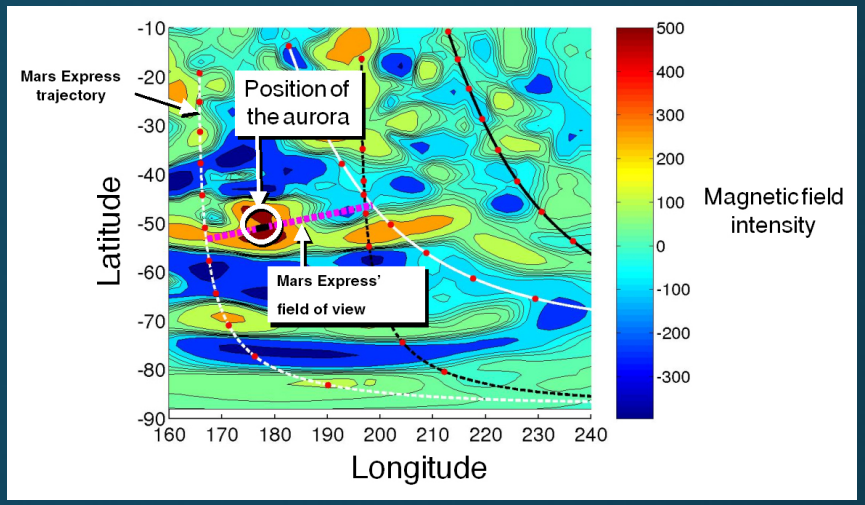


Fig. 1. Sequence of inverse brightness images at 130.4 nm for Nov. 21-23, 1979, with PVO apoapsis near terminator plane. Legend is at right. Note bright emissions near midnight for orbit 352.

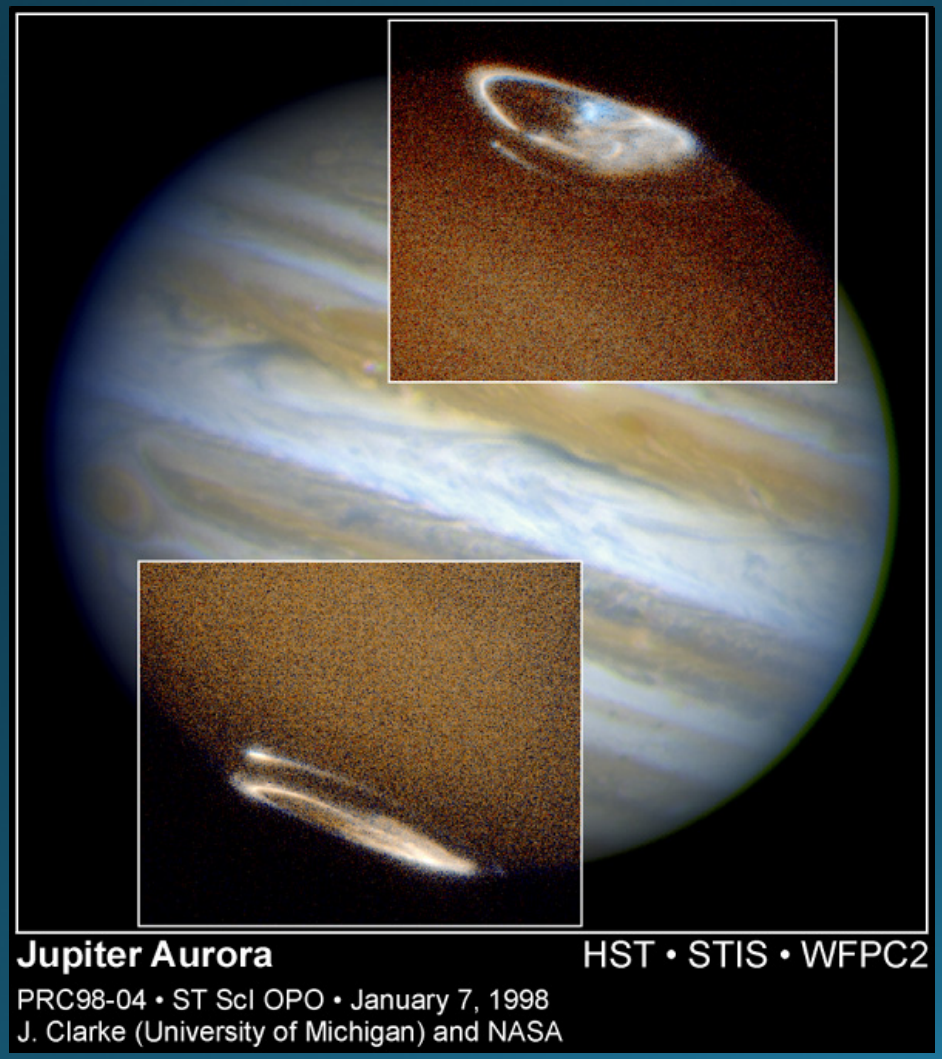
Mars



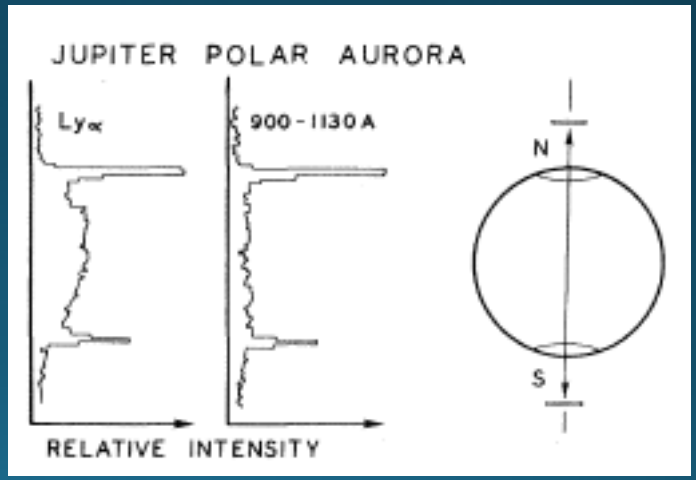


Aurora on Mars were detected by Mars Express (Bertaux et al.2005)

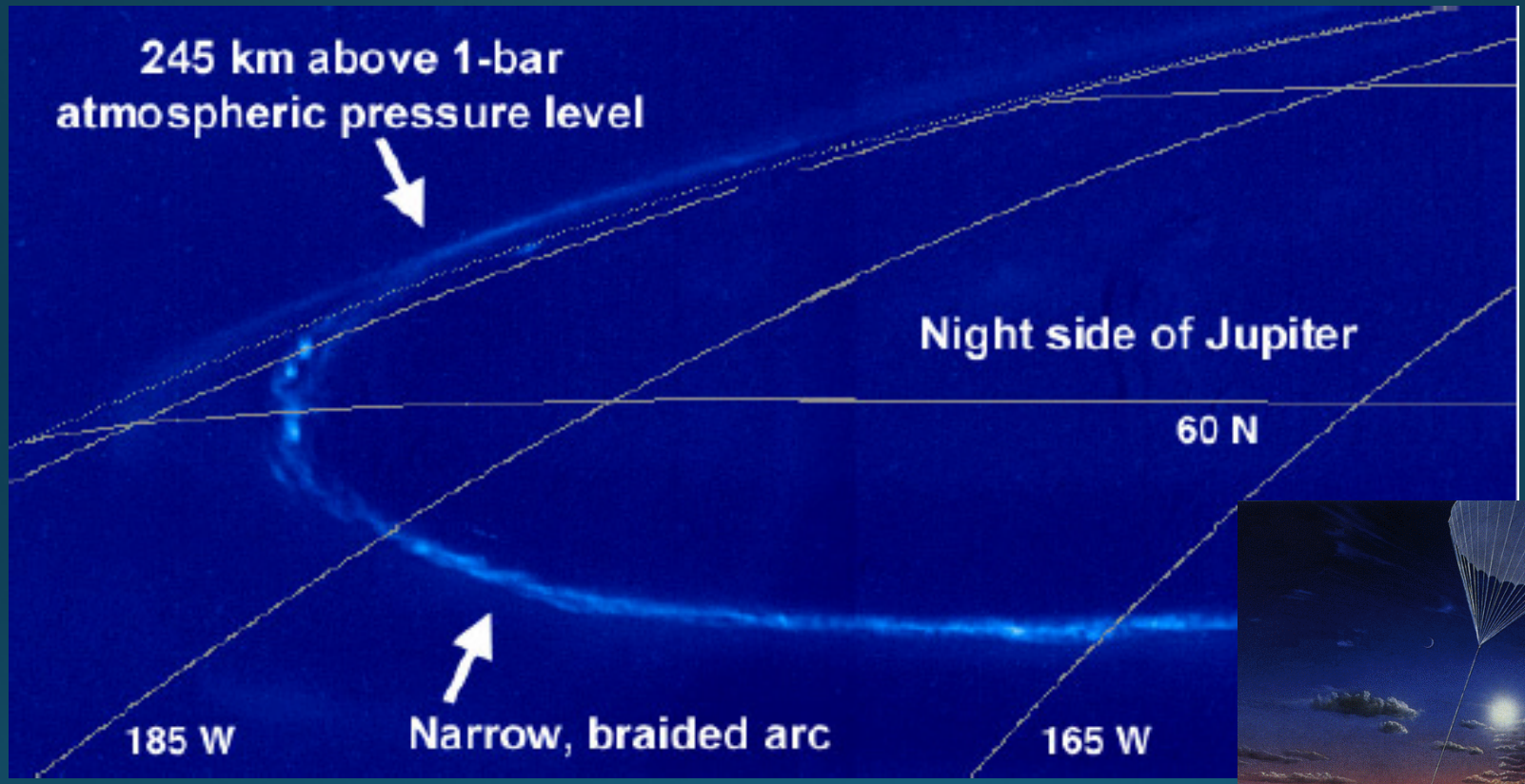
Jupiter



Jupiter's polar aurora detected in 1979 by Voyager 1 and 2 (below, L. Broadfoot et al., B. Sandel et al., LPL, UA). Later the UV aurora have also been observed with the Hubble Space Telescope (left).

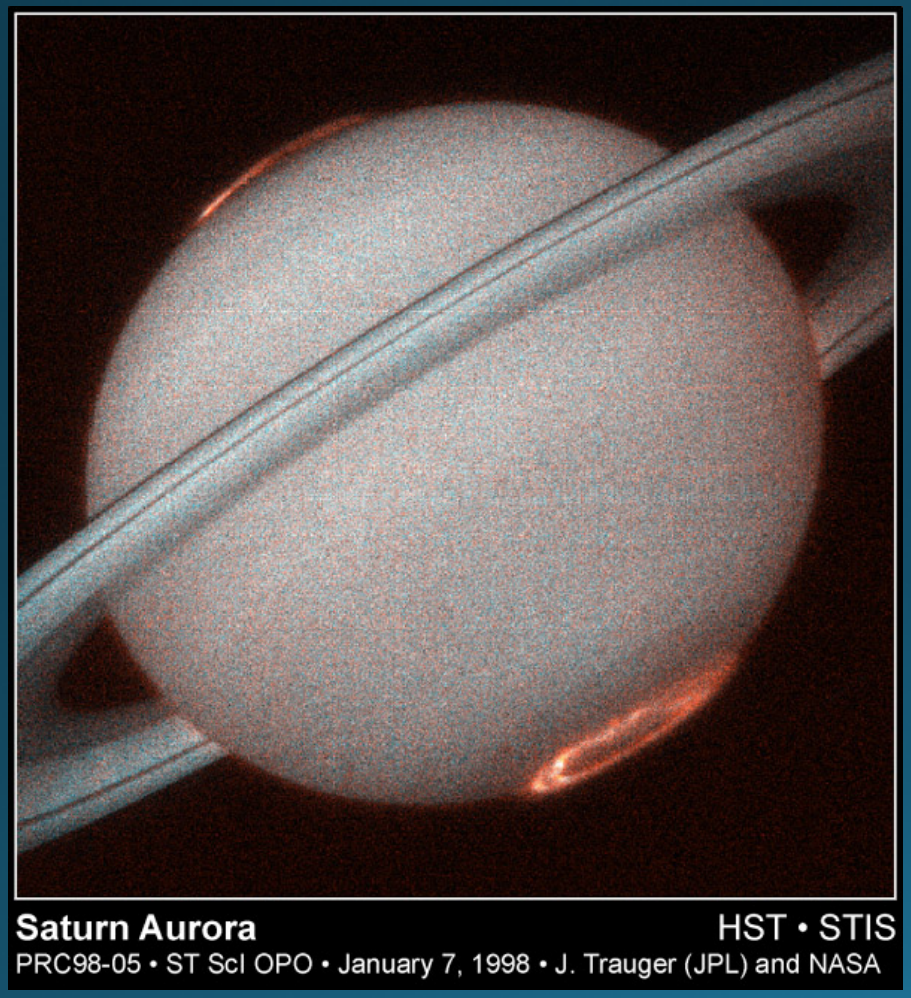


Jovian visible aurora

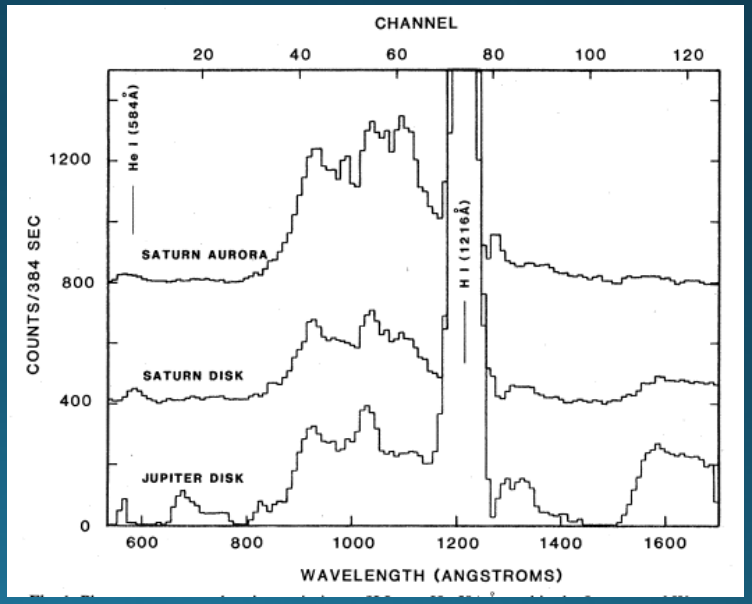


From Vasavada et al.(1999). The image was taken by NASA's Galileo spacecraft, which arrived at Jupiter in December, 1995 and launched the Galileo probe into the Jovian atmosphere (artist impression right).

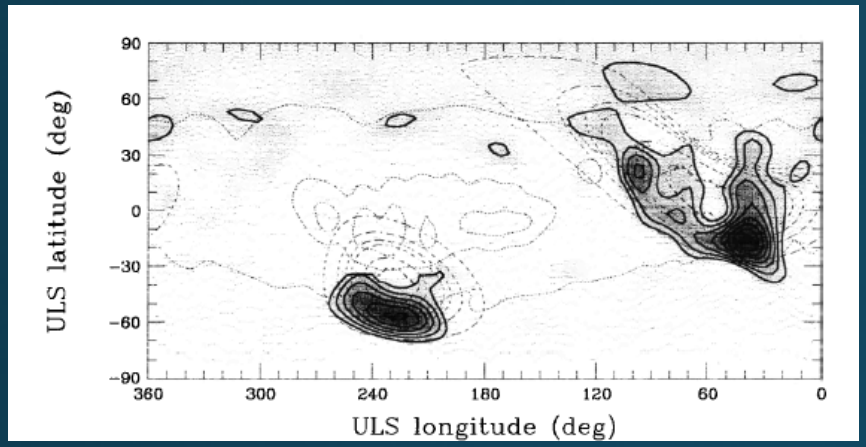
Saturn

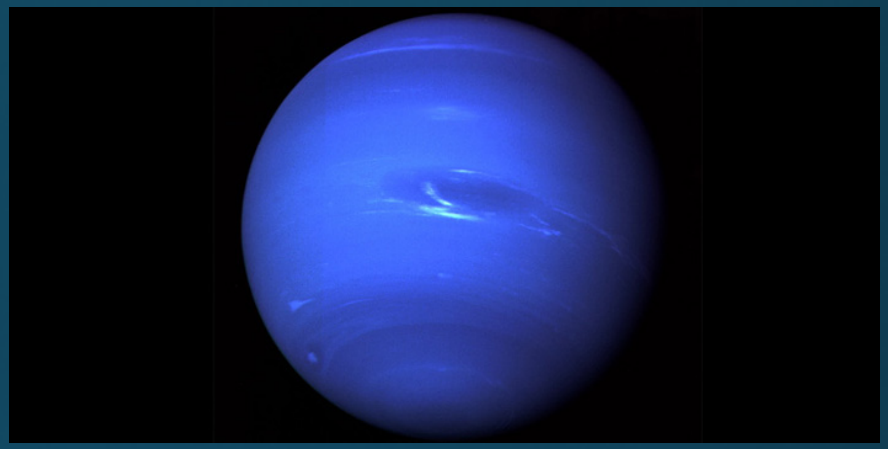


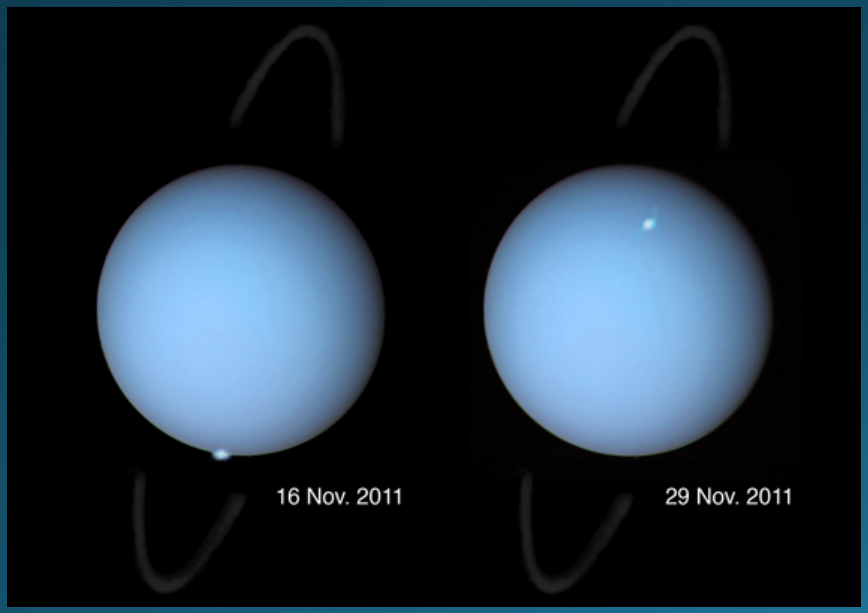
Voyagers 1 and 2 detect UV aurora on Saturn (Broadfoot et al.1981, Sandel et al.1982).



The Ice Giants: Uranus and Neptune







Uranus H_2 aurora based on Voyager 2 observations (above left, Broadfoot et al.1986, Herbert and Sandel 1994, 1999). HST images of Uranus aurora (left, Lamy et al.2012).