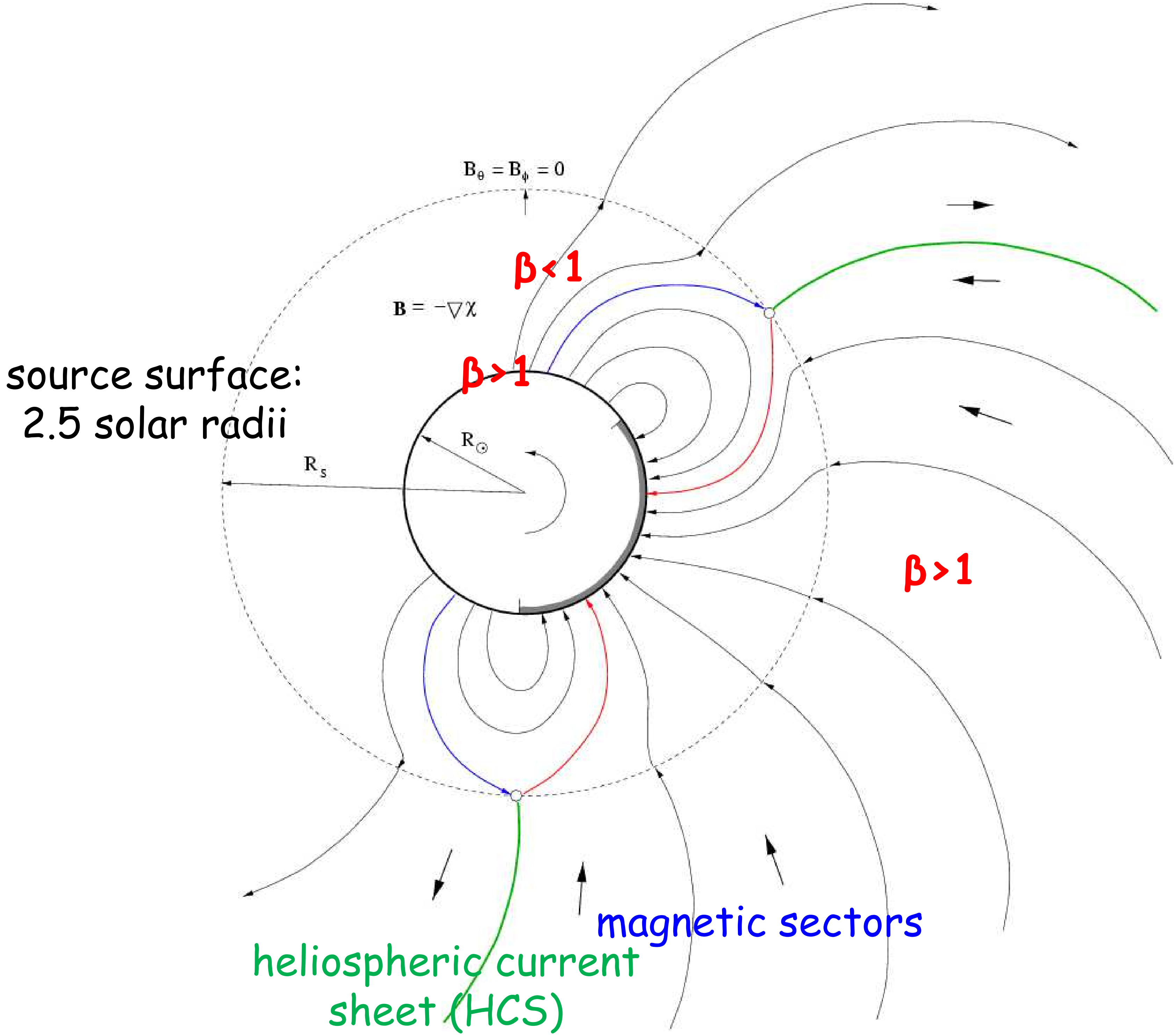
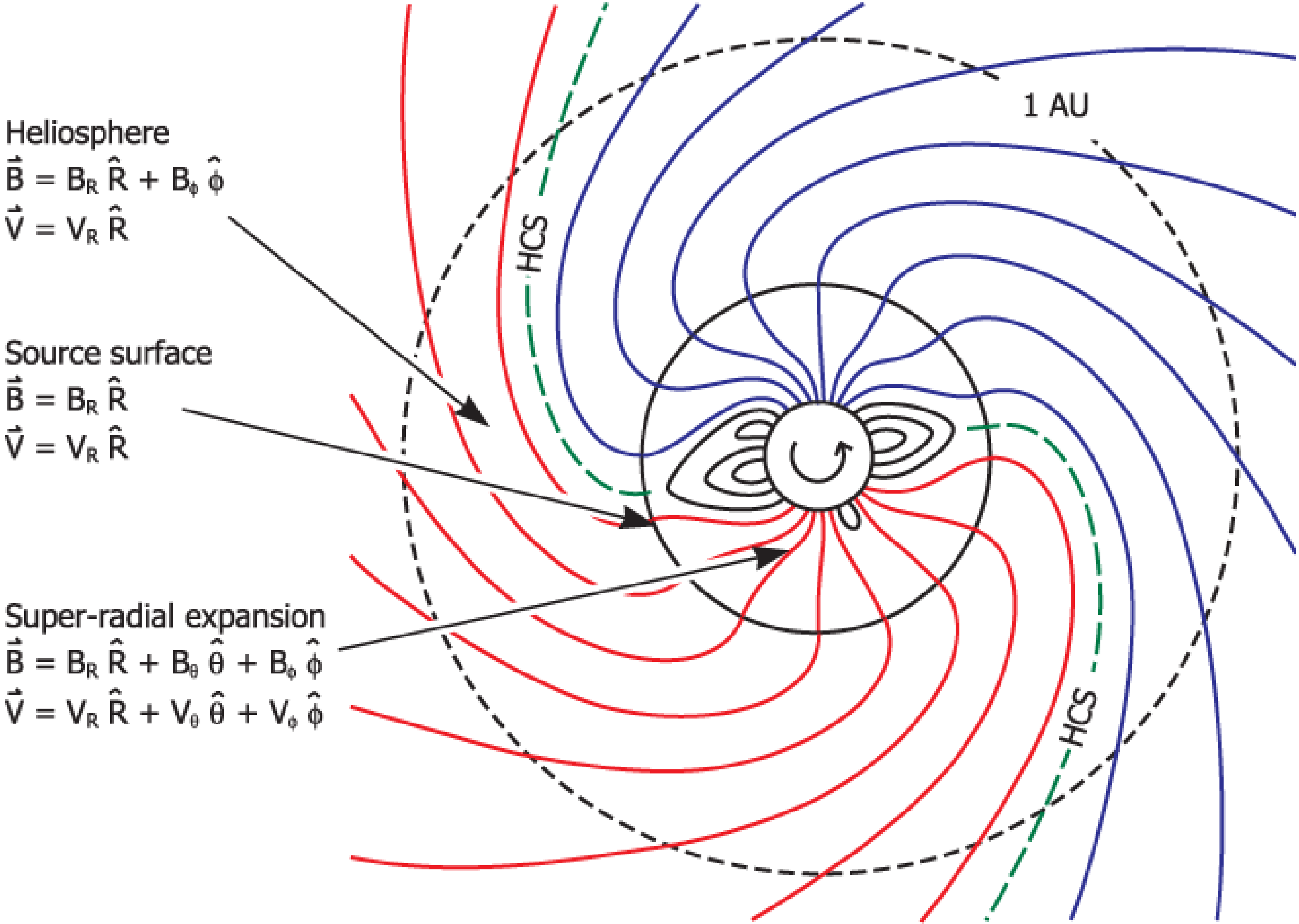
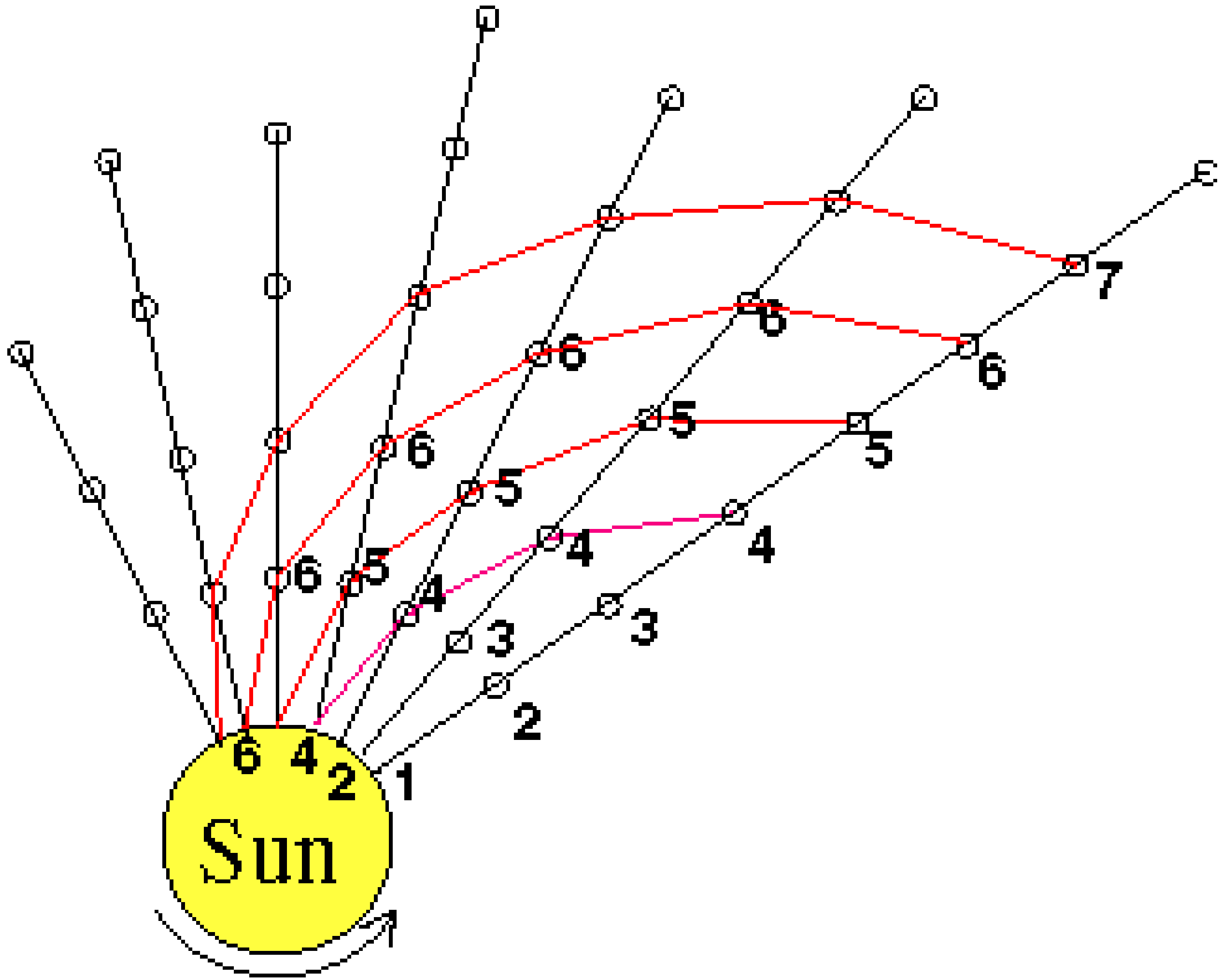


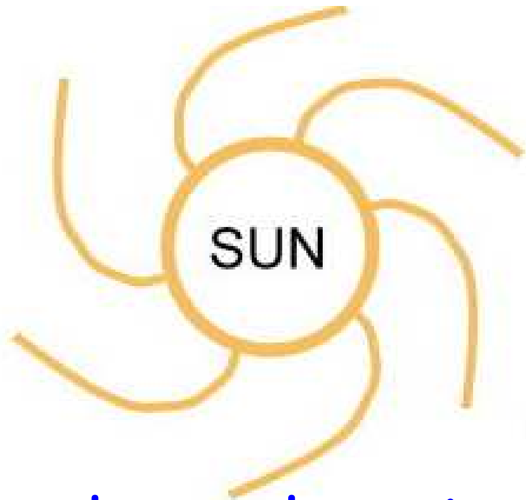
http://sprg.ssl.berkeley.edu/~tohban/nuggets/?page=article&article_id=29



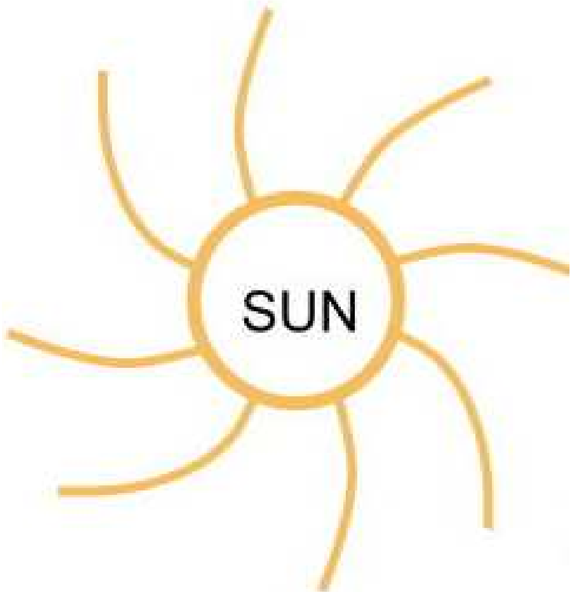
http://solarphysics.livingreviews.org/Articles/lrsp-2013-5/fig_1.html

Parker Spiral





slow solar wind

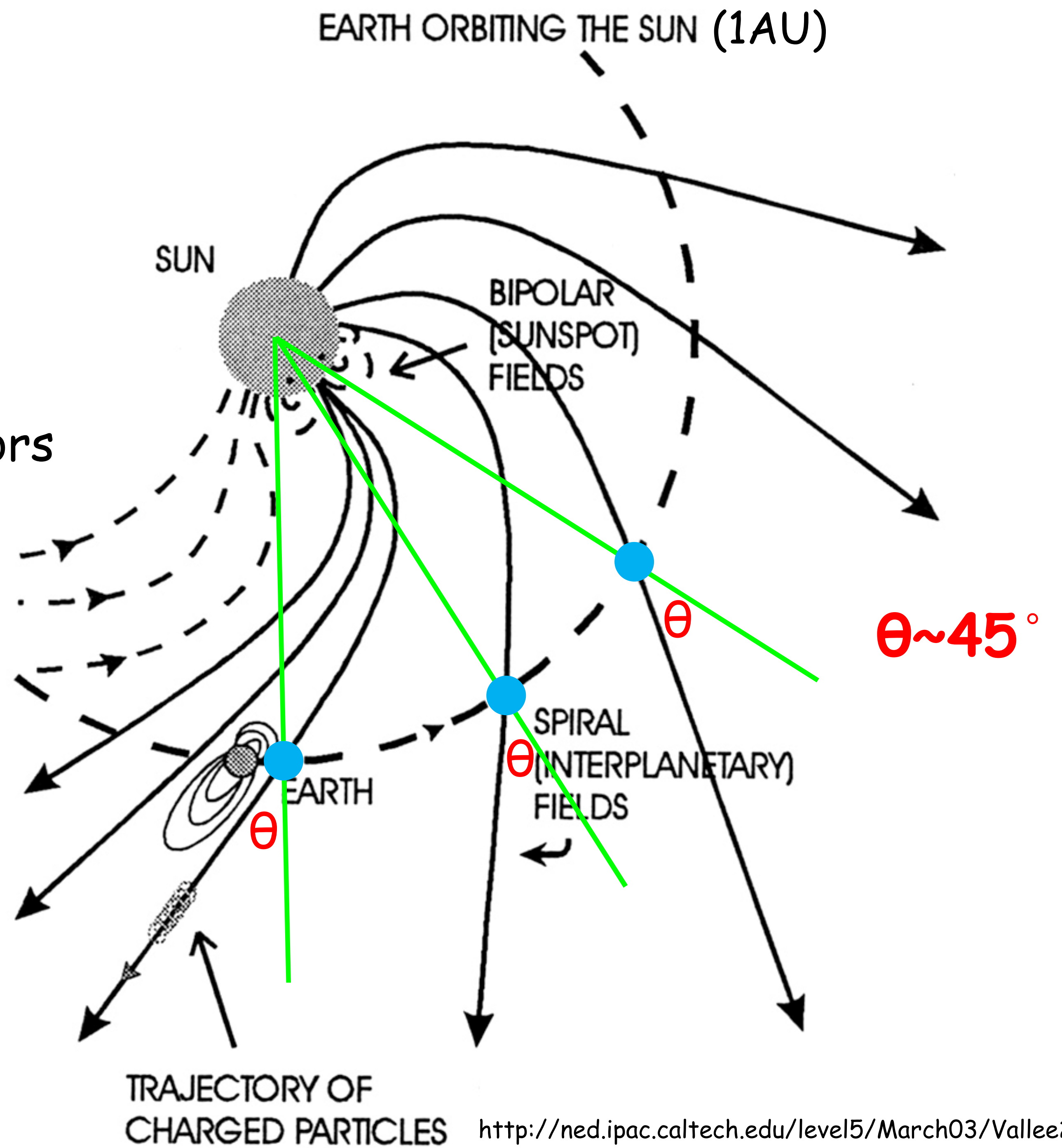


fast solar wind

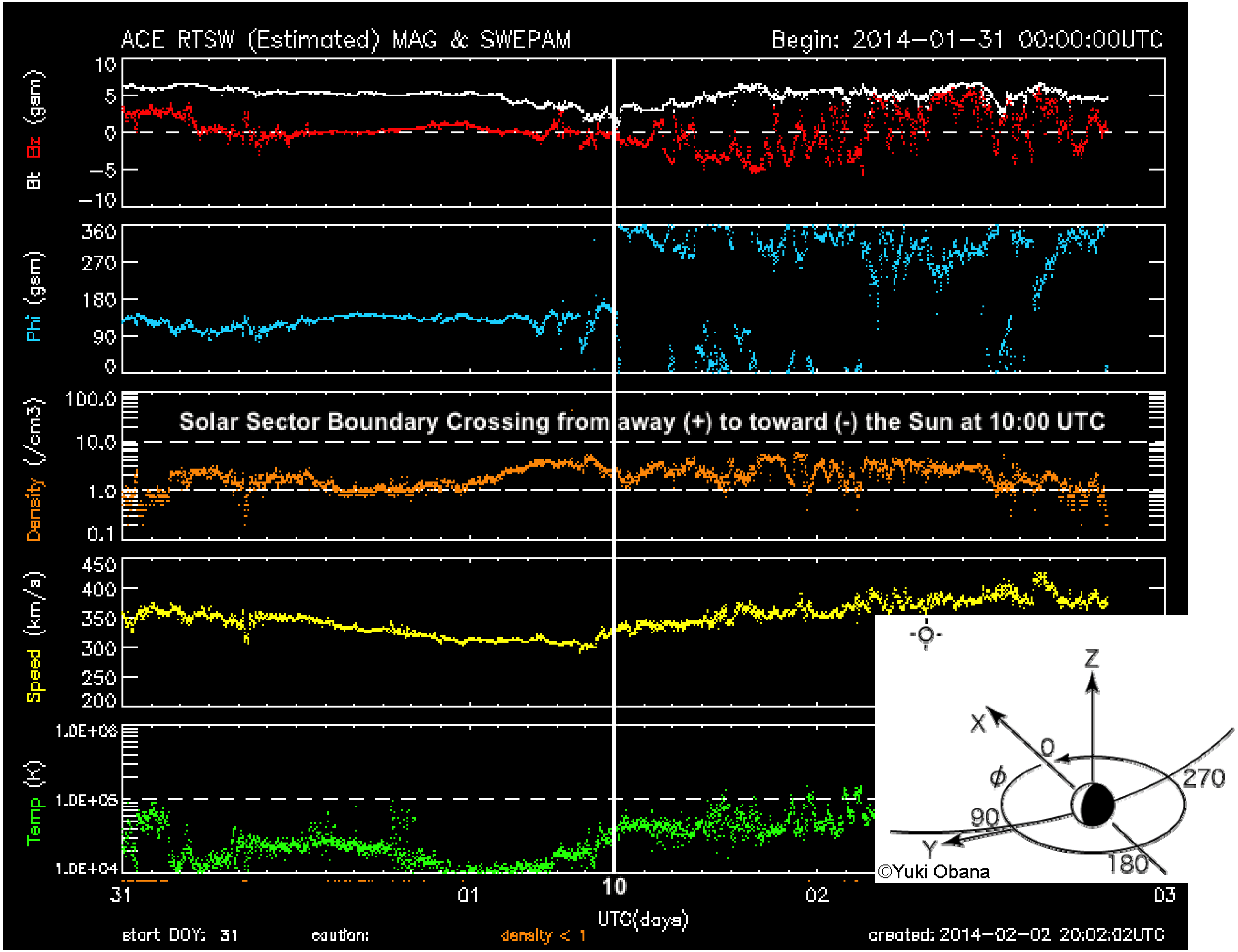
http://www.phy6.org/Education/wimfproj.html

Magnetic Sector Structure

magnetic sectors

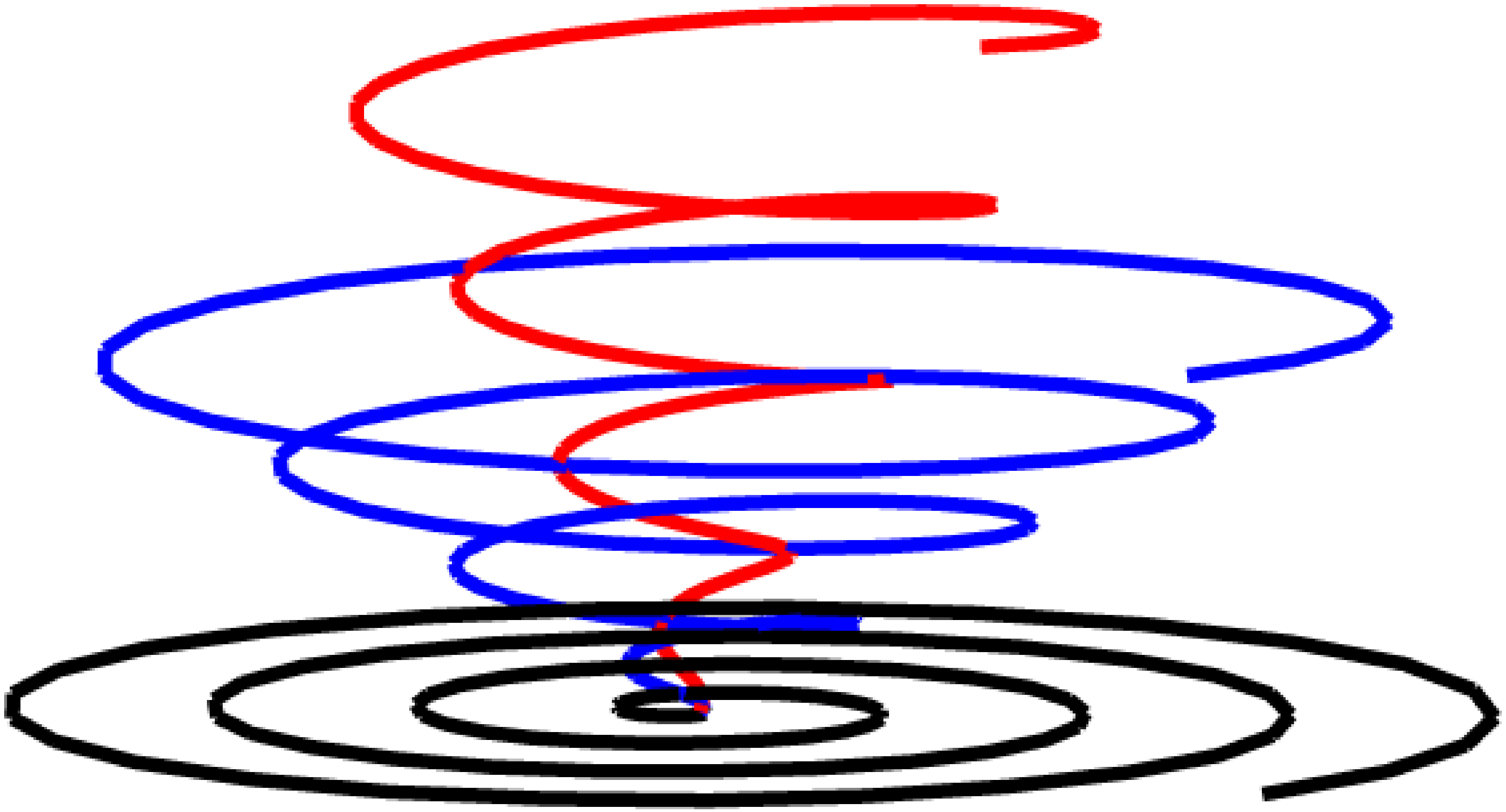


http://ned.ipac.caltech.edu/level5/March03/Vallee2/Figures/figure5.jpg

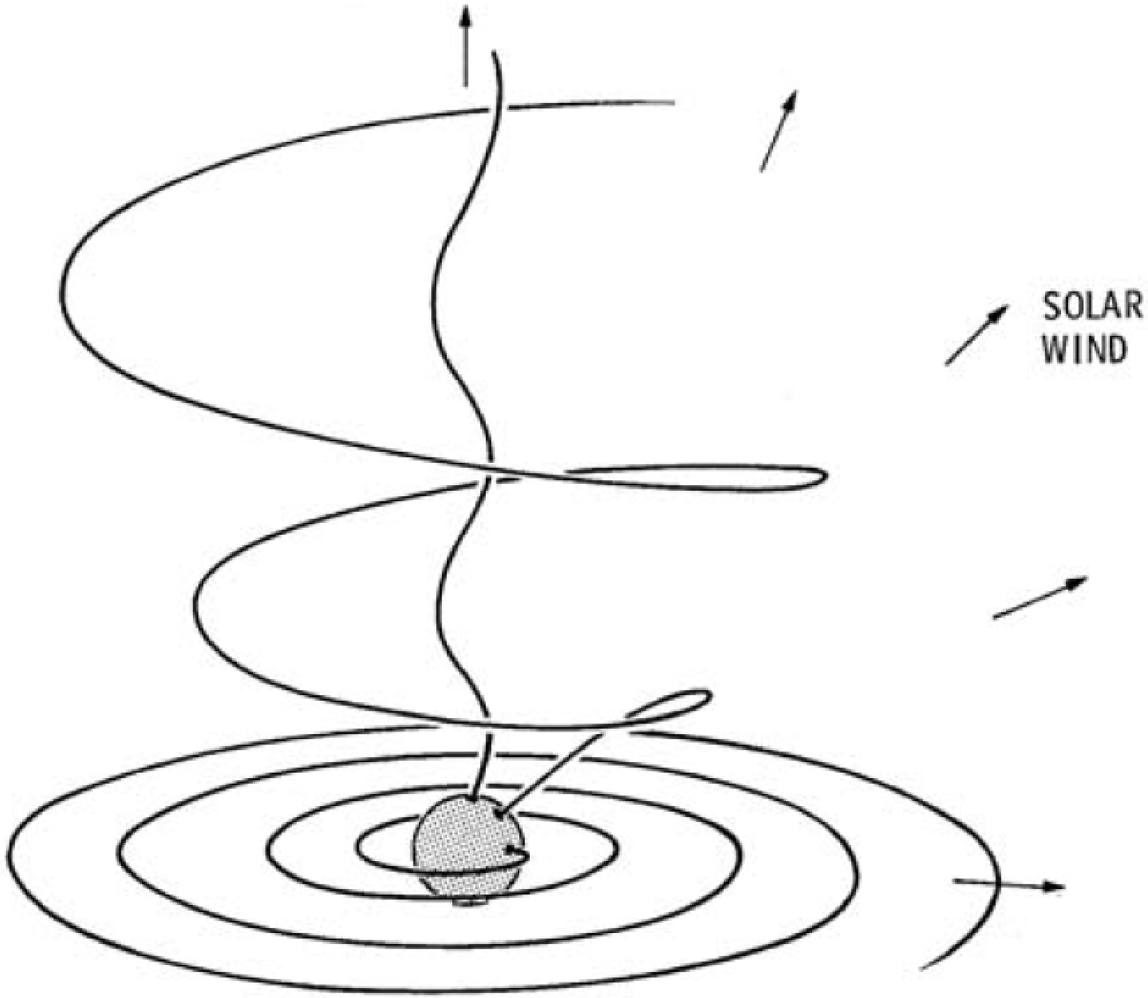


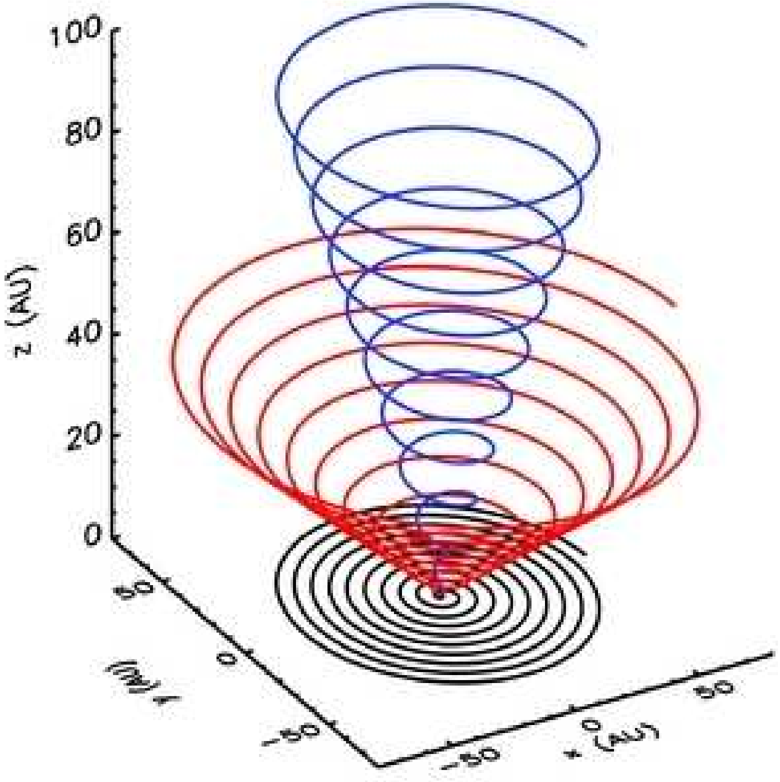
http://www.suspicious0bserverscollective.org/1/post/2014/02/solar-sector-boundary-crossing-on-february-1st-2014-research-notes.html

Ideal Parker spiral magnetic field lines between 0 and 25 AU for a solar wind speed of 450 km s^{-1}. Black, blue, and red lines show heliographic latitudes of 0, 30, and 60 degrees, respectively.



http://solarphysics.livingreviews.org/Articles/lrsp-2013-5/fig_3.html





http://iopscience.iop.org/article/10.1088/0004-637X/741/1/23

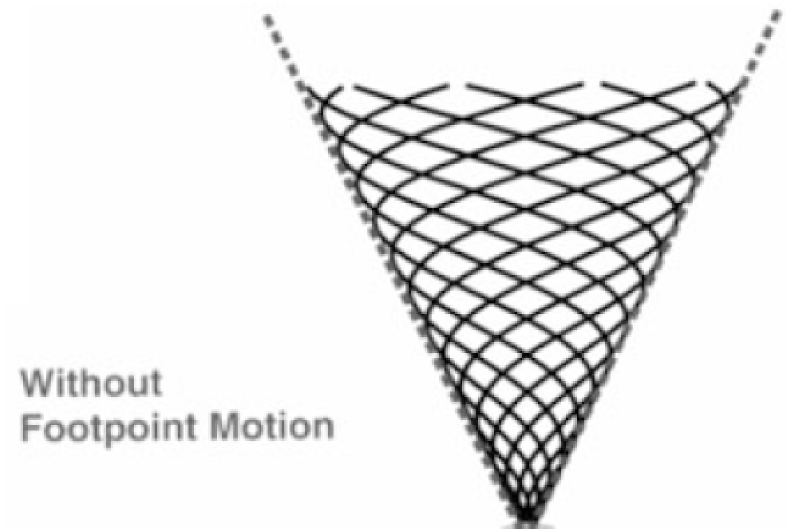


Fig. 4.2 (p.83) in Balogh et al. (2008)

Fig. 6.12 (p.134) in Simnett et al. (2017)

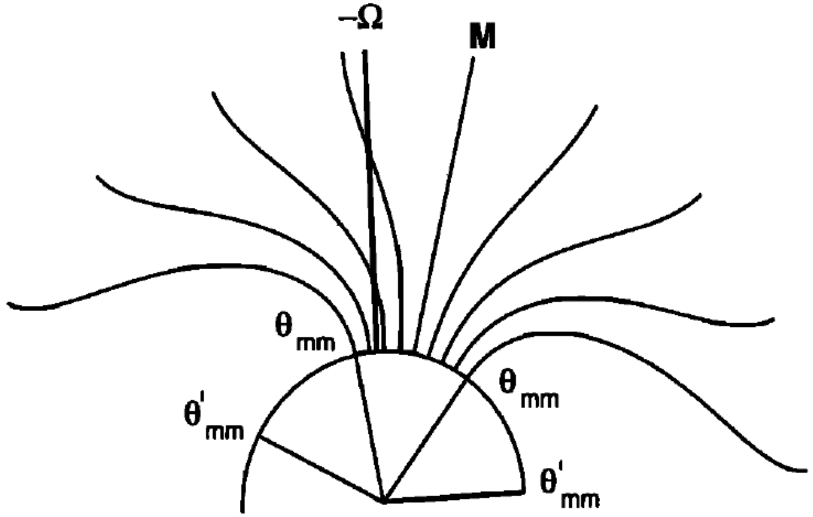
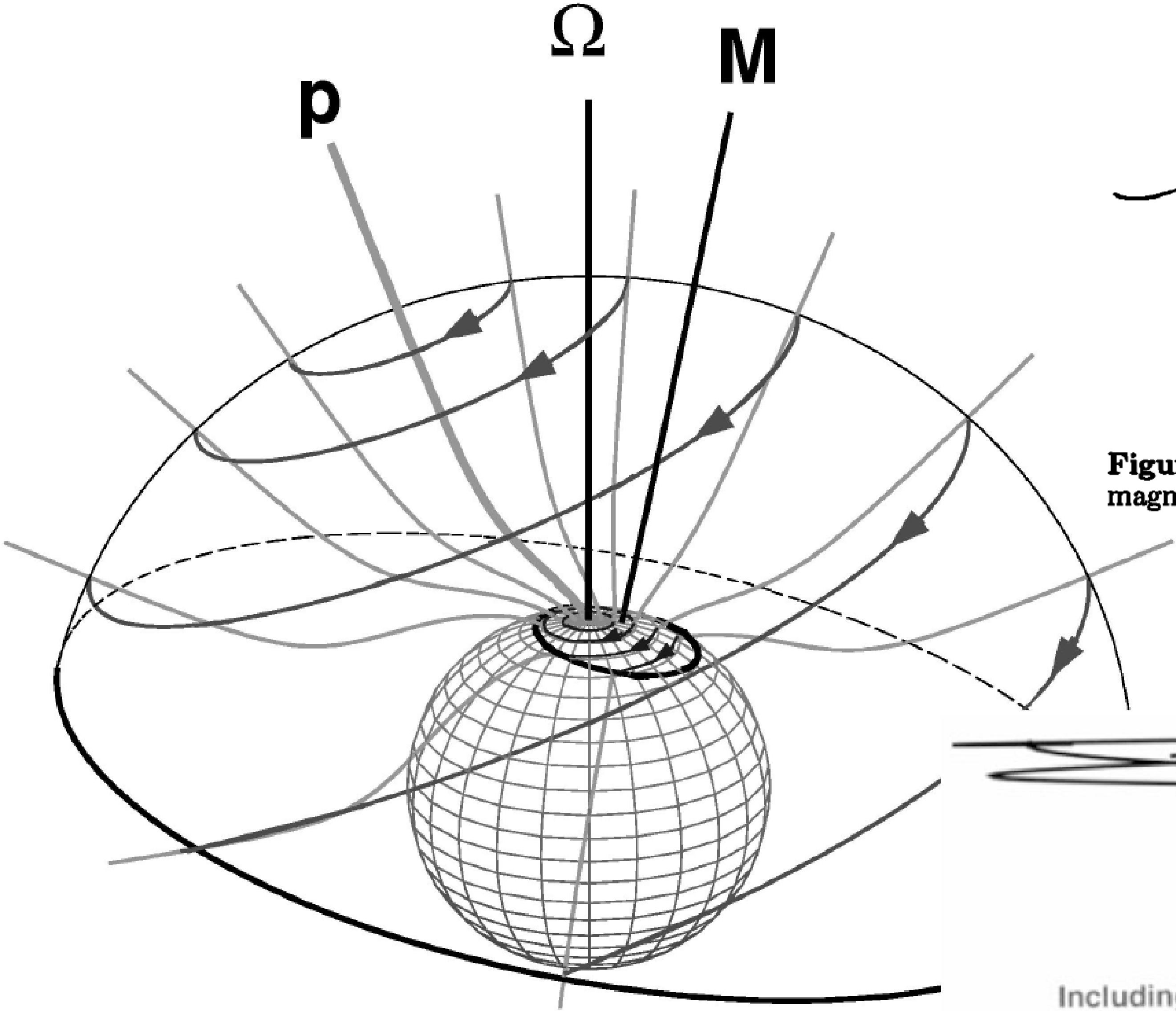


Figure 2. A schematic illustration of the expansion of magnetic field lines from a polar coronal hole.



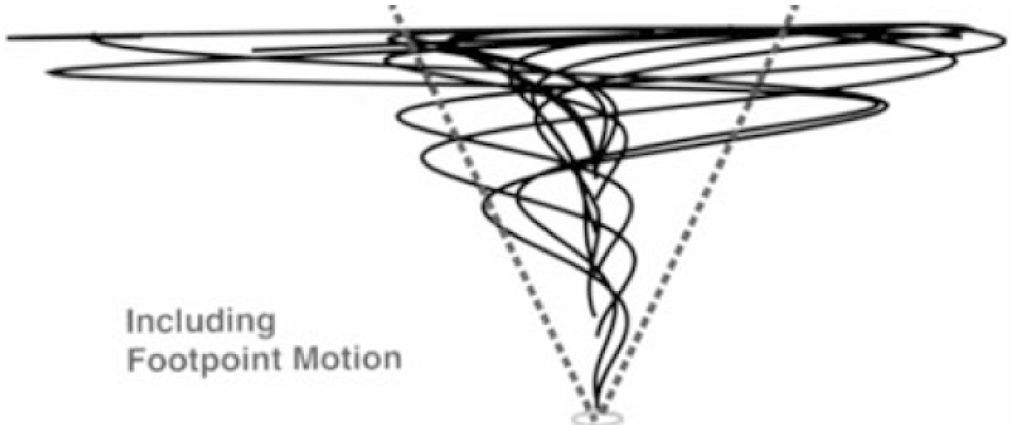


FIG. 1.—An illustration of the motions of the magnetic field in the corona, in the polar coronal hole, as predicted by the model of Fisk (1996, after Zurbuchen et al. 1997). The outer surface, which is defined in the text, is penetrated only by field lines which open into the heliosphere and which have essentially constant magnetic pressure. The figure is drawn in the frame corotating with the equatorial rotation rate. The M-axis is the axis of symmetry for the expansion of the magnetic field from a polar coronal hole. The Ω-axis is the solar rotation axis. The open lines are field lines, with p marking the field line that connects to the solar pole. The curves with arrows are the trajectories of the field lines, the motion of which is driven by differential rotation of the photosphere.

Fisk et al. (1999) Fisk (1996) Fig. 6.12 (p.134) in Simnett et al. (2017)

The Fisk model leads to equations for the field components that differ significantly from the Parker equations:

$$B_R = B_o\left(\frac{r_o}{r}\right)^2$$

$$B_\theta = \left(\frac{B_o r_o^2}{r V_R}\right)\omega \sin\beta \sin\left(\phi + \frac{\Omega r}{V_R} - \phi_o\right)$$

$$B_\phi = \left(\frac{B_o r_o^2}{r V_R}\right)\left[\omega\left(\cos\beta\sin\theta + \sin\beta\cos\theta\left(\phi + \frac{\Omega r}{V_R} - \phi_o\right)\right) - \Omega\sin\theta\right]$$

The field strength at the source surface located at r_0 is B_0. The co-latitude and longitude in heliographic coordinates are θ and ϕ, and ϕ_o is the longitude of the magnetic pole. The differential rate of rotation, $\omega = \Omega - \Omega(\theta)$—that is, the difference between the angular velocity at the equator and at high latitudes (not the angular velocity at high latitudes).

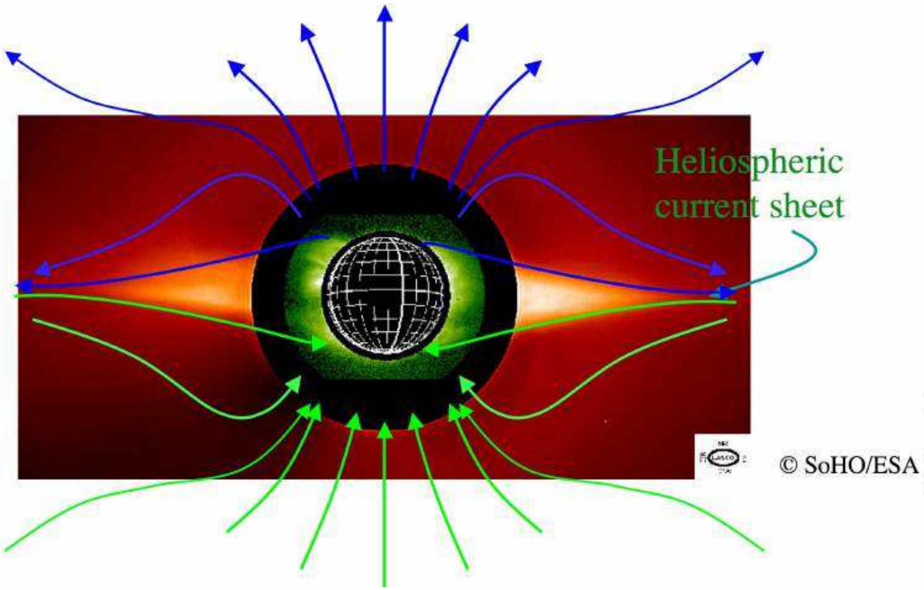
When $\beta = 0$, the equations reduce to the Parker equations:

$$B_\theta = 0$$

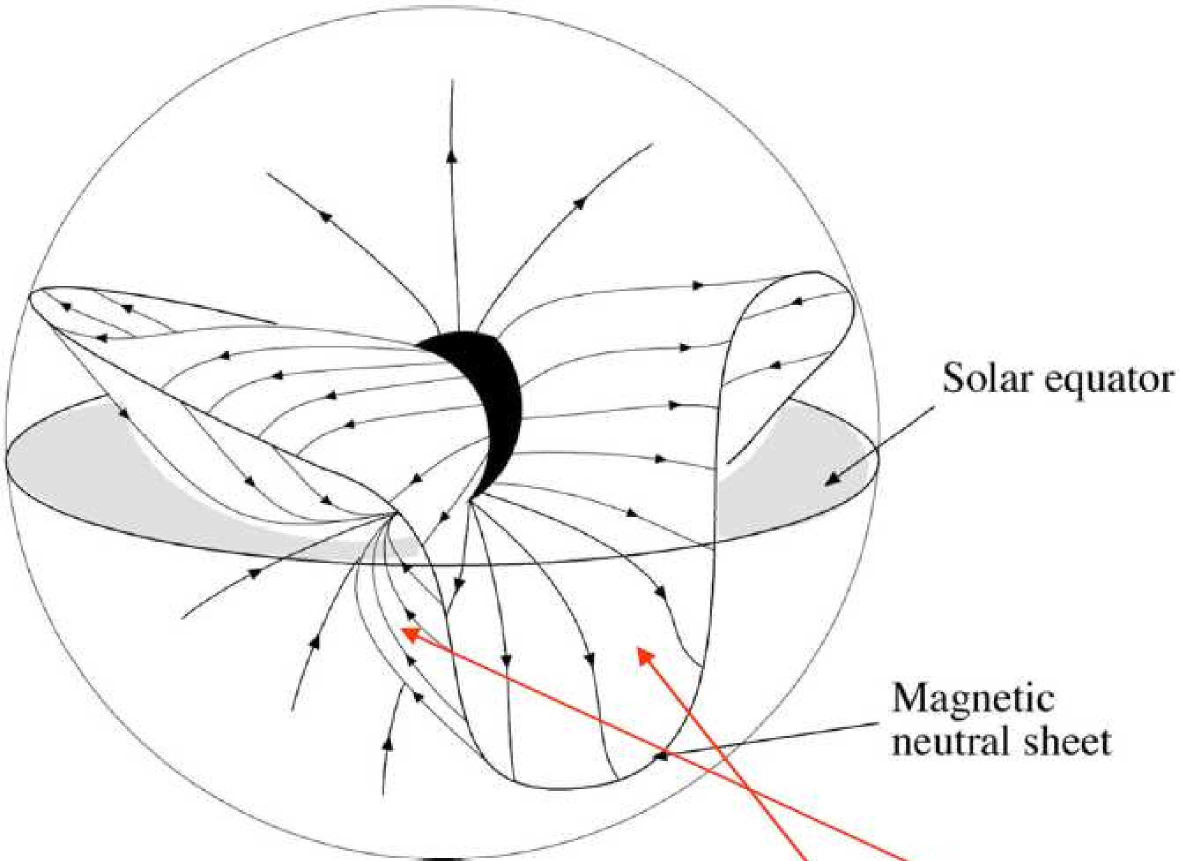
$$B_\phi = \left(\frac{B_o r_o^2}{r V_R}\right)[(\omega - \Omega)\sin\theta]$$

p.113 & 114 in Balogh et al. (2008)

Heliospheric Current Sheet

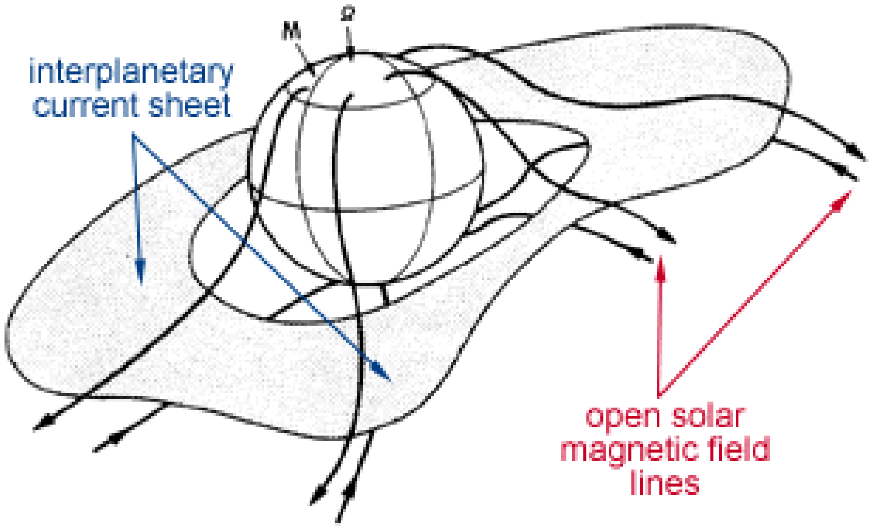


http://www.nmdb.eu/?q=node/135



"ballerina skirt"

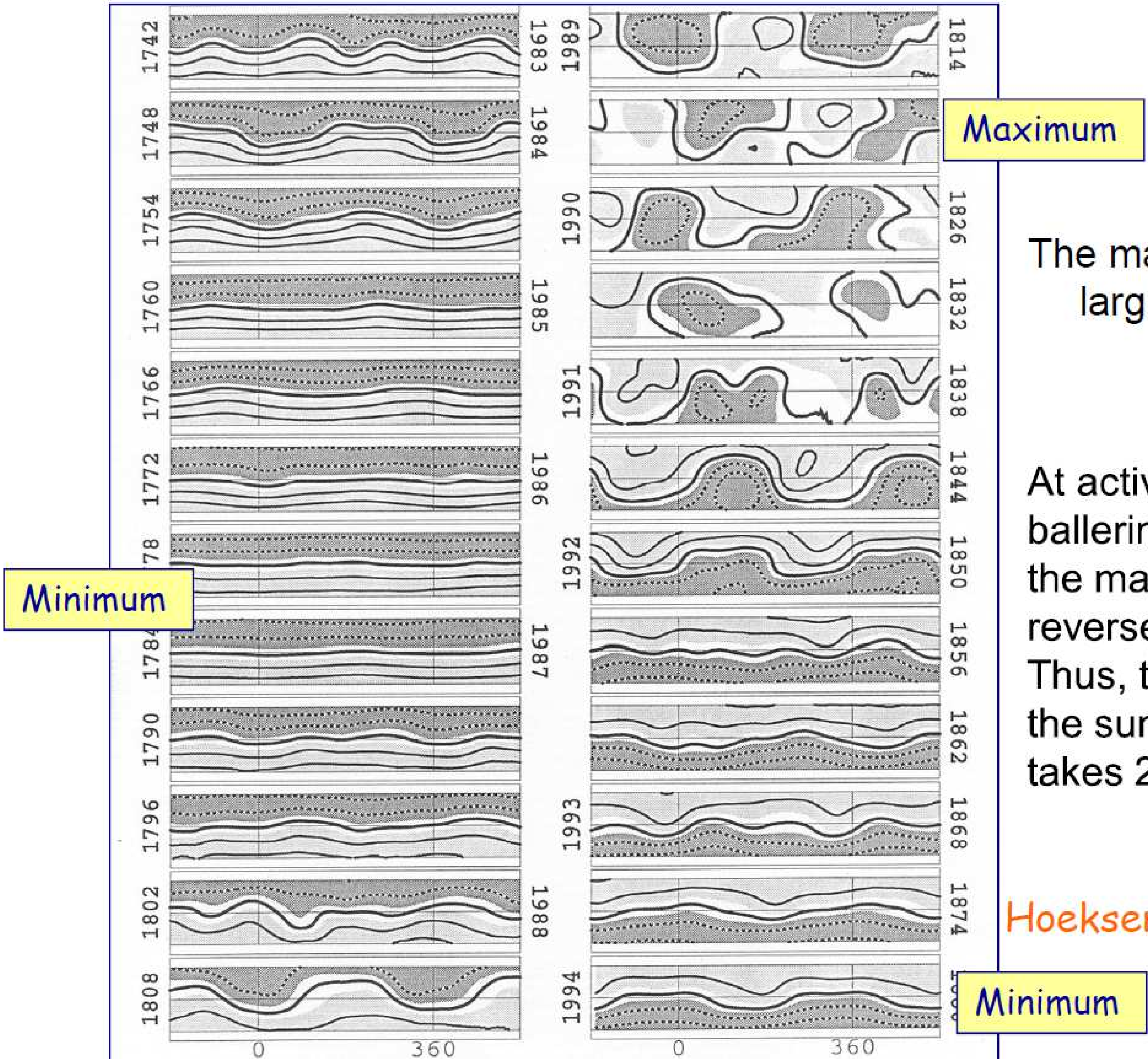
The Earth can be "toward" sector or in "away" sector



http://pluto.space.swri.edu/image/glossary/IMF.html

http://theory.physics.helsinki.fi~plasmainfo.html

The ballerina dancing through the solar cycle



The magnetic topology of the large-scale heliosphere

At activity maximum, the ballerina skirt flips over, and the magnetic polarity is then reversed at next minimum. Thus, the magnetic cycle of the sun (the “Hale-cycle”) takes 22 years!

Hoeksema, 1995

http://theory.physics.helsinki.fi~plasmainfo.html