Basic topology and dynamics of magnetic field leading activity the Sun

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Text of Abstract

- Observations of the large scale magnetic field in the photosphere taken at the

Wilcox Solar Observatory since 1976 up to 2005 have been analyzed to deduce
its latitudinal and longitudinal structures,
its differential rotation, and their variability in time.

The main results are the following:
- The latitudinal structure of the solar magnetic field with a period of polarity change of 22 years consists of four zones: two sub polar and two pre-equatorial with boundaries around +25, 0 and -25 degrees.
- The presence of the polarity waves running from the equator to the poles with quasi 2-year period has been clearly demonstrated
- North-South asymmetry of solar magnetic field and its short and long term variability in time have been studied.
- Differential rotational rate of the magnetic field and its temporal dependence has been evidenced at different latitudes through activity cycles.
- Extremely interesting quasi-stable over 30 years longitudinal structure has been found. Its relation to the latitudinal topology of the magnetic field was studied.
- Longitudinal structure in different coordinate systems rotating differentially like the photosphere does and with different constant rates were reconstructed.

These results are fundamental for the understanding of the magnetic origin of the solar activity, dynamics, the heliospheric structure and for the prediction of the solar wind and magnetospheric perturbations.