



## Quasi-periodicities and empirical modes of the Heliospheric Magnetic Field

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Quasi-periodicities in solar-heliospheric phenomena including variations in the heliospheric magnetic field have attracted attention in the past. In a recent analysis of variations in the Sun's open magnetic flux over 3 1/2 solar cycles, a quasi-periodicity of approximately one and one-half years was evident in the radial component and field magnitude. Inspection of this signal showed it to be variable in both amplitude and period. Power spectra proved marginally useful in analyzing the signal so we applied a new technique called Empirical Mode Decomposition (Huang et al., 1998) that treats both the frequency and amplitude as time-dependent. This technique extracted the mode near 1 and 1/2 years as well as the much-studied mode near 140 days (seen in flares, energetic particles, the magnetic field and anomalous cosmic rays) that was not evident by inspection alone. Other quasi-periodicities or four additional modes are also present that have been seen in the past in various parameters. We have also analyzed subsets of the entire 40year interval in which quasi-periodicities have previously been reported in order to compare the results using this newer technique. The results of these analyses will be presented and the possible origins of the several periodicities will be discussed.

Reference:

Huang, N. E. Z. Shen, S. R. Long, M. C. Wu, H. H. Shih, Q. Zheng, N.-C. Yen, C. C. Tung, and H. H. Liu, *Proc. R. Soc. Lond.*, **A 454**, 903-995, 1998.