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# TRANSIENT PERIODICITY IN SOLAR ACTIVITY

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**The famous recently discovered 155 d period of solar activity is shown to be a result of planetary configurations (Mercury –Venus + heliocentric configurations of major planets). The 155 d period is described as transient for it is seen at high maxima of solar activity.**

KEY WORDS **Solar activity: periods**

In previous work it has been shown that the Fourier spectrum (periodogram) of solar activity based on the Wolf numbers observed from 1749 to 1983 consists of peaks responding to certain planetary configurations (paired or multiple planetary heliocentric conjuctions or oppositions). The configurations Jupiter –Saturn ($P(1) = 19.86/2 = 9.93$ yr) and Jupiter+Neptune ($P(0) = 11.06$ yr) are responsible for the main periods of solar activity (9.94 and 11.11 yr, respectively). The outstanding role of these two periods in the complex spectrum of the oscillations may be due to the resonance phenomena or kidnapping of solar dynamo periods (see Kurochkin, 1992); we do not refer to further publications because of their boundless number).

In the last few years many publications dealing with the newly discovered period of solar activity ($P$ = 154–155 d = 0.422 yr) have appeared. The most sceptical authors, however, comment on the unsteadiness of the period of 155 d and its being clearly distinguished only in the most recent (No. 19–21) cycles of solar activity. Variations of the length of the cycles (the drift of the period from 130 up to 185 d long) have been pointed out (Judith, 1990; Carbonell and Ballester, 1992).

We shall describe the solar activity cycles that emerge and fade as transient.

The recently discovered 154–155 d cycle and its evolution with time may be explained in details by a series of planetary configurations, if not only the paired, but also the multiple ones are considered.

The period of the heliocentric conjuctions Mercury–Venus is $1/P_{ij} = 1/P_i - 1/P_j = 1/0.24 - 1/0.615 = 2.54$ (0.394 yr or 144 d). Taking into account the main oscillations $1/11\overset{a}{.}11 = 0.09$ and $1/9\overset{a}{.}94 = 0.10$ we obtain $P_{ijkl} = 2.54 - 0.10 - 0.09 = 2.35$ (0.425 yr or 155 d).

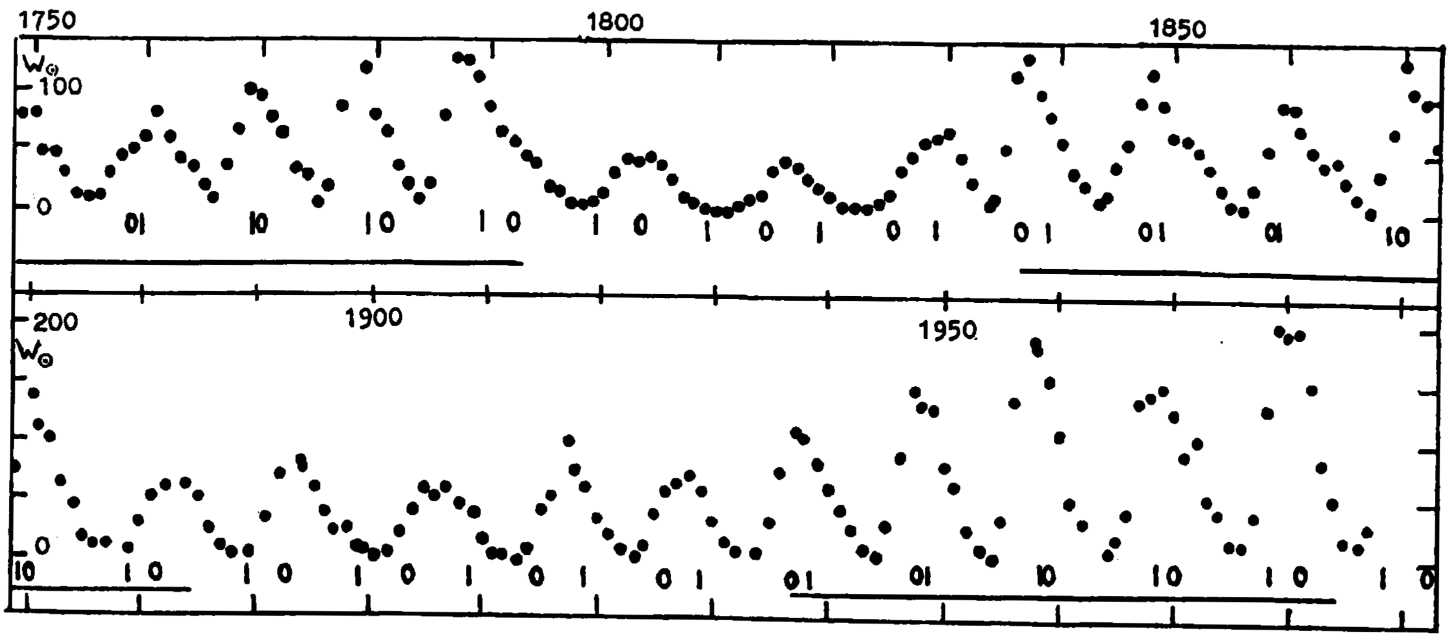


**Figure 1** The Wolf numbers curve for 1750–1990. The high maxima regions are underlined. The precalculated maxima with periods of 9.94 and 11.11 yr (see Kurochkin, 1992) are denoted by the lower indexes 0 and 1, respectively. The sequences of high maxima of Wolf numbers occur when 0 and 1 are near to each other or together.

So, the principal characteristics of the 155 d cycle may be explained by the configurations of at least five planets: Mercury, Venus, Jupiter, Saturn and Neptune. The major planets create the main background for the double mode oscillations of activity. The two principal cycles, the 11.11 and 9.94 yr ones, streng then each other if their maxima coincide or fall close to one another. At such epochs repeated every 90–100 years the highest maxima of solar activity are observed for then the 155 d cycles bound with the configurations of the inner planets, in particular those of Mercury and Venus, are strngthened and pronounced.

Other planetary configurations are possibly strengthened also, but they are screened by greater oscillations (resonance?) and, partly, by scientific fashion, which makes the performance of a thorough periodogram analysis still more difficult. The manifestations of the 155 d cycle in recent years should be linked with the parade of the planets of the year 1986 — the major planets gathered at heliocentric longitudes of about the more distant major planets still remain there. However, we are approaching a series of low maxima of solar activity and the fading of the 155 d period (which will be reduced again to the 144 d cycle typical for the Mercury–Venus configurations). The periods of configurations of the inner planets become more pronounced at such epochs.

The 155 d period manifestations are due at time intervals presented in Figure 1. The events take place at the epochs of the highest maxima, when the Wolf numbers maxima for the periods of 9.9 and 11.11 yr are close to one another or coincide (the down index 0 or 1). Figure 1 is reproduced from the previous publication of the author (see Kurochkin, 1992).

*References*

Carbonell, V. and Ballester, J. L. (1992) *Astron. Astrophys.* **255**, 350.
Judith, L. (1990) *Astrophys. J.* **363**, 718.
Kurochkin, N. E. (1992) *Astron. Astrophys. Trans.* **1**, 305.