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13-Day Oscillation in the Cosmic-Ray Intensity

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The 13-day oscillation in the cosmic-ray intensity at Huancayo and Fredericksburg, during the years 1973-1974, is related to the modulation connected with the regular high-speed solar-wind streams.

Relaciona-se a oscilação de 13 dias na intensidade da radiação cósmica em Huancayo e Fredericksburg, durante os anos 1973-1974, com a modulação associada a fluxos velozes regulares do vento solar.

In a recent work N. lucci et *al.*[1] have identified two classes of high-speed solar-wind streams: respectively regular high-speed streams and complex high-speed streams. In connection with the former there is an interplanetary magnetic field with constant polarity and regular level behaviour, and a characteristic cosmic-ray intensity modulation with rapid initial decrease and subsequent recovery. This behaviour has been pointed out, without going deep into the problem, by Wilcox and Ness[2], from December 1963 to February 1964, in relation with an interplanetary -magnetic-field corotating structure having four sectors.

During 1973 and 1974, the presence of regular high-speed streams looks almost exclusive and an individual solar rotation cycle turns out to be divided into two sectors with magnetic fields of opposite polarity, having the same average duration (about 13 days).

To show the connection between the presence of an oscillation of about 13 days in the cosmic-ray intensity, (isolated with periodical analysis[3] from the data recorded through shielded ionization chambers at Huancayo and at Fredericksburg[4]) and the above mentioned rnodulation

phenomenon, we carried out an investigation performed by superposed epoch analysis, taking as zero day the first day of each magnetic sector. The analysis has been extended to the geomagnetic index Kp. In fig. 1 and fig.2, the obtained results are reported, separately for 1973 and 1974, both for the cosmic-ray intensity and for the Kp index. (The cosmic-ray data are given in millesimal of the mean intensity in the considered interval).

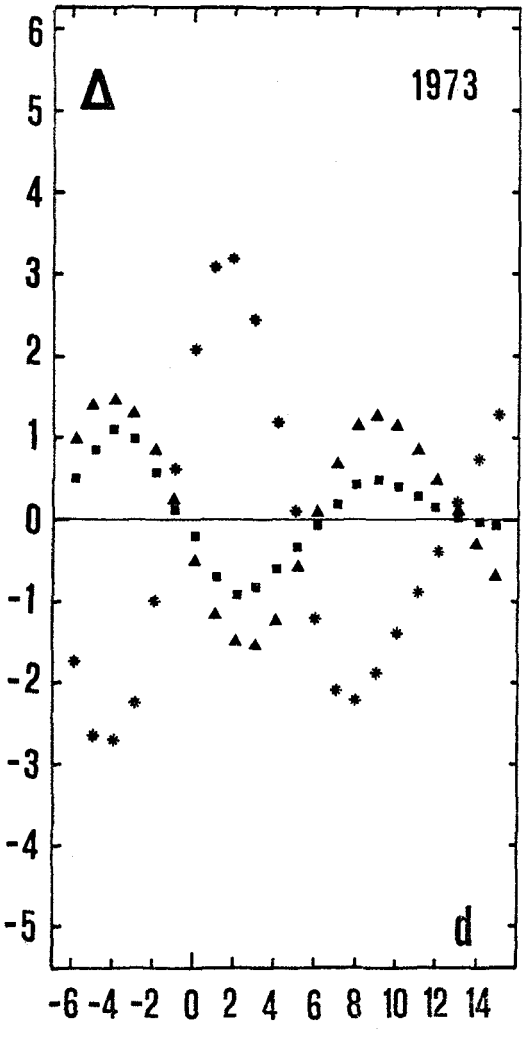

Fig.i - Superposed epoch analysis graphs - 1973 (▲ cosmic-ray intensity at Huancayo, ■ cosmic-ray intensity at Fredericksburg; ✱ Kp index).

As regards the former, a wave with a period of about 13 days turns out to agree for the two places. This wave passes through zero, decreasing, in relation with the change of the interplanetary magnetic field polarity. Its amplitude looks statistically significant as regards the criterion 3σ.

This wave is in agreement both as trend and as phase with the modulation pointed out in[1,2]. Wilcox and Ness[2] notice, afterwards, in

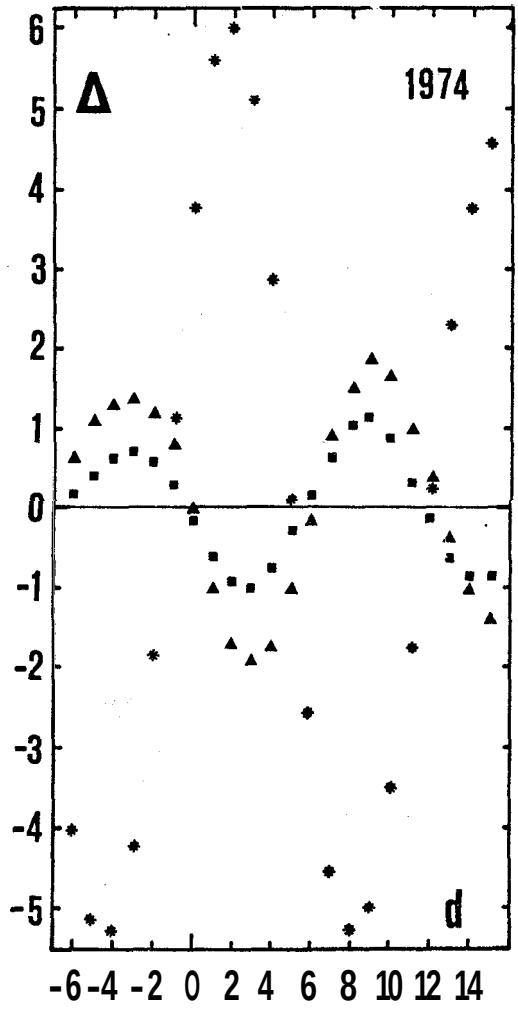

Fig.2 - Superposed epoch anaiysis graphs - 1974 (Δ cosmic-ray intensity at Huancayo, ■ cosmic-ray intensity at Fredericksburg; ✱ Kp index).

their data, a modulation amplitude with the positive magnetic field hiqher than the one with the neqative field. The same event is clearly noticed in thedata of 1973; on the contrary, in the 1974 data there is practically parity of modulation for the two interplanetary magnetic field polarities. Therefore, the event looks as casual.

The trend of the wave for the geomagnetic index Kp is practically in phase opposition with the cosmic-ray intensity, in good agreement with what is pointed out in[2,5].

Then, in the two examined years, the oscillation of about 13 days comes out strictly controlled by the above-mentioned modulation phenomenon.

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