THE OBSERVATION OF TOTAL SOLAR ECLIPSE ON MARCH 29,2006 IN KAZAKHSTAN

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ABSTRACT. The observations of total solar eclipse on March 29, 2006 were carried out by forces of united expedition of Fesenkov Astrophysical institute in Kazakhstan (settlement Mugalghar, Actobe region). The main problem was the interferometric observations of the outer solar corona at distances from 3 to 10 solar radii. The field of radial velocities of dust was obtained by Doppler shifts of absorption lines.

Key words: Sun: solar eclipse, F-corona; radial velocity.

1. Introduction

The problem of observation of field of dust radial velocities in the outer solar corona in first was set and realized during total solar eclipse July 31, 1981 (Shcheglov et al., 1987; Shestakova, 1987). At this moment it was seemed that the performance of such tasks is principally impossible, insofar as on elongation, exceeded 4 solar radii, the brightness of atmosphere background exceeds the corona brightness.

2. Observations

The coronograph with artificial moon, shutting the inner corona up to $2.5R_S$, where R_S - radius of the Sun, the interference filter with half-width $10\mathring{A}$ on region of line MgI λ 5173Å, Fabry-Perot etalon and CCD matrix Apogee Alta-10 were used under making of observations. The field of view of telescope exceeds 5^o, what allowed to receive the information about radial velocities of dust in outer solar corona for distances from $3R_S$ to $10R_S$.

The duration of the eclipse totality was 170 seconds at the Sun altitude above horizon $27^o.5$. The non-winder weather and completely clear sky with the low brightness were in the day of eclipse. The two working images were taken during total phase. The first image(exposition 130 seconds)contains the information about radial velocities of dust in the F-corona. The emission rings of scattered in optics light of green coronal line λ 5303Å are seen on second image (exposition 20 seconds. The two images of daily sky, received before and after totality, are used as reference images. The results of both treatments are coincided in limits $\pm 10km/s$.

The twenty absorption lines distributed at distances from 3 to 11 solar radii are taken for processing. Among them there are all three lines of green triplet Mg I: λ 5184Å, λ 5173Å and λ 5167Å, and also some weak lines. The spectral resolution $\delta\lambda_{1/2} = 1\mathring{A} \pm 0.1\mathring{A}$ was derived on emission lines $\lambda 5303\mathring{A}$. It was carried on the 18 diameter scans with interval of 10^o. The reference point of positional angles is began from ecliptic north pole counter-clockwise. The east direction is 90^o, and west is 270^o. Thus, the total volume of measurements is 20 lines on 36 directions.

3. Results

The average values of measured radial velocities versus the distance from the Sun (averaged on all 36 directions) are represented on Fig.1. In such average method the all velocities corresponding to orbital motion of dust around the Sun must be compensated. Thus, Fig.1 mainly reflects the radial motion of dust relatively the Sun.

On Fig.2 the averaged radial velocities versus the positional angles are represented. Such average method allows to allot the influence of orbital motion of dust. If the orbital motion of dust is like circular, the Doppler negative velocities must be observed near $P = 90^o$, and the Doppler positive ones near $P = 270^o$. In first it was obtained on results of 1981 year observations (Shcheglov et al.,1987.

Thus, the results of 2006 year observations confirm the predomination of negative velocities (Fig.1) at near distances from Sun ($r < 4R_S$). The averaged radial velocities on all distances (Fig.2) does not show the presence of regulate orbital motion of dust as it was observed at 1981 year (Fig.3).

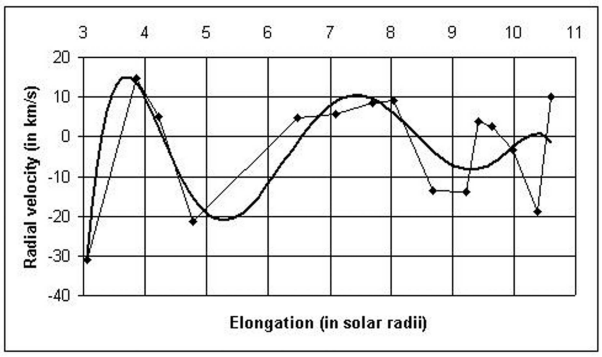

Figure 1: The average on all positional angles radial velocities versus the distance from the Sun. The solid line - the observation approximation by polynomial of 6-th order.

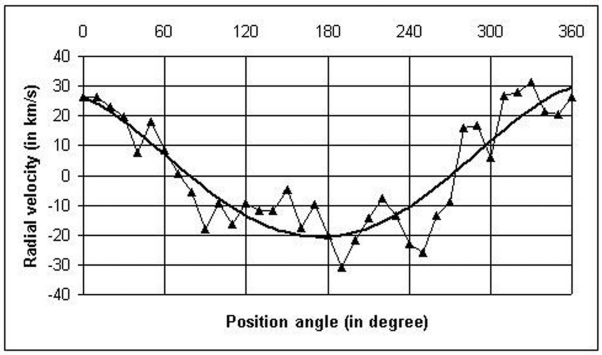

Figure 2: The averaged on all distances radial velocities versus positional angle. The reference point - the ecliptic north pole. 90^o - east, 180^o- south,270^o - west. The solid line - the observation approximation by polynomial of 4-th order.

4. Discussion

Evidence of fast disturbing action of non-gravitational forces on dust particles is the absence of clearly seeing orbital motion of dust at near-by distances from the Sun. Really magnetic field of the Sun can act on dust grains of small dimension $< 1mkm$. It seems to be natural the conclusion about predomination of grains of comet origin rather than asteroid one, insofar as the sizes of comet particles are small and the orbits are no practically connected with ecliptic plane.

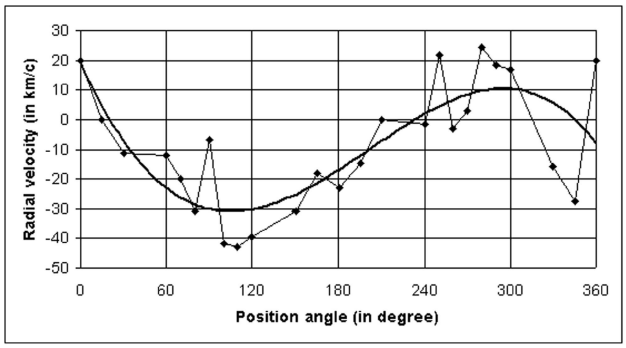

Figure 3: The averaged radial velocities in the F-corona on July 31, 1981. The solid line - the observation approximation by polynomial of 4-th order.

Perhaps, in investigated region the composition of dust grains is changed with time. The results of action of the Sun magnetic field on these particles might also be changed in connection with variations of solar activity (1981-year of maximum, and 2006-year of solar activity minimum). The new theoretical approaches should be needed for more careful analysis of 2006 year observations.

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