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# Surges of the weak magnetic field in the photosphere of the Sun

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The properties of the magnetic fields of the solar photosphere are investigated, in particular, the distribution of fields of different polarity over the solar surface. As primary data, synoptic maps of the photospheric magnetic field of the Kitt Peak National Solar Observatory for 1978-2016 were used. Using the vector summation method, the non-axisymmetric component of the magnetic field is determined. It was found that the nonaxisymmetric component of weak magnetic fields B < 5 G changes in antiphase with the flux of these fields. Magnetic fields of B < 5 G constitute a significant part of the total magnetic field of the Sun, since they occupy more than 60% of the area of the photosphere. The fine structure of the distribution of weak fields can be observed by setting the upper limit to the strength of the fields included in the time–latitude diagram. This allows to eliminate the contribution of the strong fields of sunspots.

On the time-latitude diagram for weak magnetic fields (B < 5 G), bands of differing colors correspond to the streams of the magnetic fields moving in the direction to the Sun's poles.. These streams or surges show the alternation of the dominant polarity - positive or negative - which is clearly seen in all four cycles. The slopes of the bands indicate the velocity of the fields movement towards the poles. The surges can be divided into two groups. The surges of the first group belong to the so-called Rush-to-the-Poles. These are bands with the width of about three years, which begin at approximately 40° of latitude and have the same polarity as the trailing sunspots. They reach high latitudes and cause the polarity reversal of the polar field. However, in addition to these surges, for most of the solar cycle (the descending phase, the minimum and the ascending phase), there are narrower surges of both polarities (with the width less than one year), which extend from the equator almost to the poles. These surges are most clearly visible in the southern hemisphere when the southern pole is positive. Consideration of the latitude-time diagrams separately for positive and negative polarities showed that the alternating dominance of one of the polarities is associated with the antiphase development of the positive and negative fields of the surges. The widths of surges and the periodicity of their appearance vary significantly for the two hemispheres and from one solar cycle to the other. The mean period of the polarity alternation is about 1.5 years.