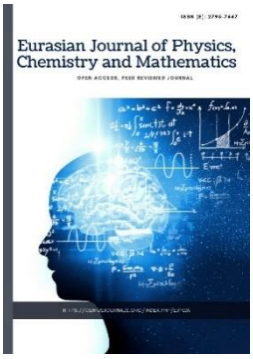

Magnetic Islands In The Sun

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ABSTRACT

The connection of solar activity with physical and biological processes on Earth, which is confirmed by the scientific research of scientists in this field in recent years, attracted the attention of many people to physical processes in the Sun.

Keywords: Astrophysicist, Maunut Wilson, photosphere, Kodaikonal, spectral, NASA.

Since the Sun is the closest among the stars to the Earth, it is important to study the physical nature of the billions of stars in the sky. The Sun is a representative of the quiet family of stars, in fact, it is constantly changing. Since the Sun is at a great distance from the Earth (149.5 million km), it is impossible to observe these changes with the naked eye. It is possible to observe three layers of the solar atmosphere, which differ from each other by their physical nature. These layers are called photosphere, chromosphere and solar corona.

It is noteworthy that all irregular objects on the Sun are genetically linked to its spots. That is why the number of spots is taken as the main index of the solar activity sign.

Sunspots are of different sizes, and the average can be about 7,000 to 15,000 kilometers. In many cases, the diameter of sunspots reaches tens of thousands of kilometers. In particular, the diameter of the Sunspot observed in 1858 was 230,000 kilometers, which is approximately 19 times the diameter of the Earth (Earth diameter is 12,740 kilometers).

When sunspots are more than 40,000 kilometers in diameter, they can be seen with the naked eye. The first information about the observation of sunspots was recorded in the 10th-11th centuries BC. However, in almost all early observations, Sunspots, Mercury, or Venus were mistakenly interpreted as transits of planets across the surface of the Sun. Even Johann Kepler attributed the large sunspot observed on May 18, 1607 to the transit of Mercury. Only Galileo Galilei observed sunspots in 1610 with the help of the first telescope he built and proved that they lie directly on the surface of the Sun. The invention of the telescope made it possible to observe sunspots more or less regularly. On April 2, 1845, physicists Fizeau and Foucault took the first photo of the Sun in Paris, which was a great achievement in this regard. Until now, it took more than a hundred years for astrophysicists to study sunspots. Nevertheless, it is not an exaggeration to say that it is difficult to find a more complex enigmatic object than spots among the objects that exist in the Sun and reflect its activity.

The spots are located in the outer layer of the Sun called the photosphere, the temperature of which is 1500 degrees lower than the temperature of the photosphere (the temperature of the photosphere is 6000 degrees). This is the main reason why sunspots appear black in the atmosphere. From the outside, Sunspots have a plate-like shape, and their depth in the middle reaches 1000-1400 kilometers. The spots are divided into two according to their brightness: the part corresponding to the bottom of the plate is completely black and is called "shadow" or core, and the part corresponding to the wall of the plate is called "penumbra". Usually the "penumbra" is surrounded by a bright ring.

Sunspots embody a strong magnetic field. This phenomenon was discovered by the astrophysicist Heap in 1908 at the Mount Wilson Observatory with the help of spectral studies of sunspots. The study of sunspots with the help of spectral lines sensitive to the magnetic field shows that the intensity of the magnetic field in their shadow reaches 4000 ersted (the intensity of the Earth's magnetic field is 0.5 ersted at the equator).

The strength of the sunspot magnetic field depends on the area occupied by the spot, and the size of the spot leads to an increase in the strength of the magnetic field. In a spot, the magnetic field is like the direction of the lines of force of a pole of a magnet where the lines of force are vertical.

Another interesting phenomenon related to sunspots is the continuous outflow of gas in their penumbra. The average speed of this current is 2 km per second, and in fact, it depends on the shape of the size of the spot. This phenomenon was first discovered by the astrophysicist Nershed in 1909 at the Kodaikonal Observatory (India) using the spectral method.

When sunspots first appear, they appear as a black dot (diametric 7000-1000 kilometers) among the granulations, and then become larger and form a penumbra around them. Spots are less likely to appear individually, and most often appear in groups. There are mainly two large spots in each group, and the rest are located around and between them. Interestingly, one of these two large spots in the group has a north pole, and the other has a south pole.

Spots are not permanent objects on the surface of the Sun, they are "born" and "die". Their average life span is from several hours to several days, only some of them can live up to 1-15 months. Only large spots live with such a long period.

One of the biggest problems in solar physics is the number of sunspots that change over the years. This phenomenon was first discovered by Danish amateur astronomer T. Gorribov during many years of observations. The period of increase and decrease of sunspots was determined by the second astronomy enthusiast G. Schwabe based on 20 years of observational materials. This period was about 10 years. Since the number and area of all other physical processes (explosions, protuberances) on the Sun also change with this period, this period is called the period of solar activity. Later, astronomer R. Wolff's long-term systematic observations made it possible to measure the solar activity period with great accuracy. According to Wolff, this period turned out to be 11.1 years on average. This period of solar activity is reflected in the course of all biological, physiological and physical processes on Earth. In particular, in the growth and development of flora and fauna, epidemics of various diseases are observed simultaneously with the period of active processes.

According to NASA, the consequences of explosions on the Sun can still have an effect. In July, the agency published data on the strongest explosion that occurred in the summer of 2012. The explosion observed at that time was more than twice the size of all similar events recorded in 150 years. If the effects of this explosion reached Earth, it would cause a catastrophe, which would knock out GPS systems, power grids, satellite networks and radio systems worldwide. It will take several years to restore them.

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