Preface

This book contains the Proceedings of the Joint European and National Astronomical Meeting (JENAM-2011) held on July 4–8, 2011 at St. Petersburg.

The main topics discussed at the meeting were:

1. The unusual sunspot minimum—challenge to the solar dynamo theory
2. New observational window: terra-Hertz emission
3. Wavy corona
4. Space weather agents—initiation, propagation, and forecast.

Now and again, the Sun sets new problems before the astronomers. One of such problems is the abnormal behavior of solar activity during the past, 23rd cycle. Even now, it is not clear whether the anomalies have ceased with the beginning of the new cycle 24 or we are still facing a long period of low solar activity. The anomalies in question have manifested themselves in various parameters, such as the sunspots per se, the number and intensity of coronal mass ejections, extraordinary brightness distributions in the corona, solar wind parameters, and the persistent big low latitude coronal holes.

We discussed at the symposium the following problems:

- What are the characteristics of solar activity that display abnormal behavior? Is it possible that we are on the threshold of a strong decrease of solar activity? Were analogous episodes in the history of solar activity? What are the similar features and differences between the activity cycles in the Sun and stars?
- Are the present-day theories able to account for strong variations in the height of the cycles (up to an order of magnitude) on one and the same star? Is it possible to predict the heights and peculiarities of the cycles on the basis of the dynamo theory?
- Are there additional arguments for the influence of planets on solar activity?

Observations in the sub-THz range of large solar flares have revealed a mysterious spectral component increasing with frequency and hence distinct from the microwave component commonly accepted to be produced by gyrosynchrotron

(GS) emission from accelerated electrons. Evidently, having a distinct sub-THz component requires either a distinct emission mechanism (compared to the GS one) or different properties of electrons and location or both. It is interesting to discuss the complete list of possible emission mechanisms.

It is the magnetic field that determines the variations of the coronal brightness. However, the mechanism of the corona heating and, therefore, of the relationship between the corona brightness and magnetic field is unclear. This is, obviously, due to the fact that there are several heating mechanisms that play different roles in different areas (active regions, quiet Sun, coronal holes). So far, it is not clear whether the DC or AC mechanisms prevail in one or another object in the Sun. What is the role of different-scale magnetic fields in the heating of the solar corona and how does their relative contribution change with time? What kinds of manifold observational waves and oscillations are significant to understand the heating of upper solar atmosphere?

The progress in studying the key objects of the Space Weather problem—CMEs and high-speed solar wind streams will be, apparently, achieved owing to a wide use of stereoscopic data from the STEREO-A and spacecraft as well as the high-quality solar obtained in several channels corresponding to different plasma temperatures (SDO). The main topics to discuss were as follows:

- The nature of coronal mass ejections and their connection to various-scale fields
- The acceleration of the solar wind and connection between the solar wind and various features in the Sun
- 3D structure and physical parameters of CME sources, including the flares and filament eruptions
- The correlation between coronal hole characteristics and the parameters of the solar wind.

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