



Radio Signatures of Shock Accelerated Electron Beams in the Corona

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The Sun is a giant particle accelerator. The generation of energetic electrons play an important role, since these electrons are responsible for the Sun's emission of nonthermal X-ray and radio radiation. Shock waves are an important agent for particle acceleration in space. Due to solar eruptive events, shock waves are generated in the corona, e. g. driven ahead of coronal mass ejections. In the solar radio radiation type II bursts are signatures of shock waves traveling through the corona. The Ukrainian radio telescope URAN-2 observed special fine structures in type II radio bursts in the frequency range 8-33 MHz. They appear as a chain of stripes of enhanced radio emission. These stripes rapidly drifts towards lower frequencies in the dynamic radio spectrum. They resemble the well-known "herringbones" in type II radio bursts and are regarded as radio signatures of shock accelerated electron beams. Adopting shock drift acceleration (SDA) for generating energetic electrons, these electrons establish a beam-like velocity distribution. Such a distribution is able to excite Langmuir waves, which convert into radio waves by nonlinear plasma processes (also called plasma emission). This process is efficient if the velocity of the beam electrons exceeds a few times of the thermal electron speed. The data of the dynamic radio spectrum recorded by URAN-2 can be related in the best way to the theoretical results, if the electron beams responsible for the "herringbones" are generated via SDA at an almost perpendicular shock which is traveling nearly horizontal to the surface of the Sun.