Solar type II radio bursts associated with CME-streamer interactions: spectral break and spectral bump

Artem Koval*(1), Marian Karlický(1), Aleksander Stanislavsky(2), Bing Wang(3),
Miroslav Bárta(1), Vladimir Dorovskyy(2), and Roman Gorgutsa(4)
(1) Astronomical Institute of the Czech Academy of Sciences, Ondřejov, Czech Republic;
e-mail: artem.koval@asu.cas.cz; marian.karlicky@asu.cas.cz; miroslav.barta@asu.cas.cz
(2) Institute of Radio Astronomy of NASU, Kharkiv, Ukraine;
e-mail: a.a.stanislavsky@rian.kharkov.ua; dorovsky@rian.kharkov.ua
(3) Institute of Space Sciences, Shandong University, Weihai, China; e-mail: wbing@sdu.edu.com
(4) Pushkov Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation
Russian Academy of Sciences, Troitsk, Russia; e-mail: rgorgutsa@rambler.ru

Type II solar radio bursts are manifestations of coronal shocks. It is believed that these bursts are excited by energetic electrons accelerated at shock waves caused by solar eruptions (i.e., flares or coronal mass ejections (CMEs)). Since the radiation is generated through the plasma emission process, the emissions are observed close to the local plasma frequency and/or its harmonics. In the solar dynamic spectra type II bursts appear as bright radio emission stripes, which drift smoothly or intermittently from high to low frequencies. Often type II bursts demonstrate complex spectral morphology (i.e., band-splitting, herringbone structure, break, bump). Evidently, the spectral shape of a type II burst depends on specific conditions during the processes of shock formation and propagation, electrons acceleration, and excitation of radiation. In particular, among different morphological features of type II bursts, we focus on spectral breaks and spectral bumps. These spectral peculiarities are attributed to the CME-streamer interaction [1-2].

In the present work, we report about radio observations on March 17, 2004 of two successive type II bursts with the above-mentioned spectral features. We have examined the overlapped solar dynamic spectra from the Nançay Decametric Array (20-70 MHz; Nançay, France), the IZMIRAN radio observatory (25-180 MHz; Troitsk, Russia) and the AIP radio spectrapolarimeter (40-80 MHz; Tremsdorf, Germany). The first type II burst has spectral break and the second type II burst has spectral bump. The shapes of the corresponding type II bursts are the same in the spectrograms that explicitly confirms their solar origin. For the first time, type II events with these features are observed close in time. It was established that these morphological features were caused by CME (shock) interacted with two streamers. We suppose that the both type II bursts were produced by the same shock, and acceleration of electrons took place at its nose and flank. We attempt to estimate the parameters of corona medium, including the streamers, along the shock path from analysis of the observed type II events. The scenarios of the CME-streamer interactions are considered.

References

[1] X. L. Kong, Y. Chen, G. Li, S. W. Feng, H. Q. Song, F. Guo, and F. R. Jiao, "A Broken Solar Type II Radio Burst Induced by a Coronal Shock Propagating across the Streamer Boundary," *Astrophysical Journal*, **750**, 2, May 2012, 7 pp., doi: 10.1088/0004-637X/750/2/158.

[2] S. W. Feng, Y. Chen, X. L. Kong, G. Li, H. Q. Song, X. S. Feng, and F. Guo, "Diagnostics on the Source Properties of a Type II Radio Burst with Spectral Bumps", *Astrophysical Journal*, **767**, 1, April 2013, 8 pp., doi: 10.1088/0004-637X/767/1/29.