3rd URSI AT-AP-RASC, Gran Canaria, 29 May – 3 June 2022

Conditions for generation of coronal and interplanetary type II radio bursts

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During eruptive events such as coronal mass ejections (CMEs) and flares, the plasma is heated, particles are accelerated, and waves are generated. The most reliable way of tracking the propagation of shock waves in the corona and heliosphere is using type II radio bursts. Type II radio bursts are signatures of electron beams which are accelerated by the shock. Modern radio observations and interpretation techniques allow us to study type II radio bursts and the evolution of the shock waves in the corona and interplanetary (IP) space.

The association between the shock wave type II radio emission has been a long-discussed problem as it is not yet known if the favorable regions are in the apex or the flanks of the shock wave. Herein, we have addressed this problem in a two-fold study, firstly, we study a coronal shock wave associated with a multi-lane metric type II on November 05, 2014 and secondly, we study an IP shock associated with a complex radio event on September 27, 2012.

We employ a novel approach, combining shock wave modelling with radio techniques such as triangulation. We first reconstruct the shock wave in 3D space using multi-viewpoint EUV and white light observations and then model the evolution of shock wave using a global MHD model of the solar corona. We performed a two-step analysis, of the global evolution of the shock wave in the corona and IP space and the localization of type II source locations.

Our results suggest that the formation and evolution of strong, supercritical, quasi-perpendicular shock wave regions are responsible for producing type II radio emission. Additionally, we show that there is a complex relationship between the temporal evolution of the shock parameters (strength and geometry) and the observed type II radio emission. This is further emphasized when the shock wave seems to interact with ambient coronal and IP structures such as streamers and the heliospheric current sheet. We show that these interactions can influence the morphology of the observed type II radio emission.