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On the source region of prolonged type III radio burst: Udaipur-CALLISTO and SDO observations

Vishwa Vijay Singh, Bhuwan Joshi, Binal D. Patel, and Kushagra Upadhyay
Udaipur Solar Observatory, Physical Research Laboratory, Udaipur 313001, India
e-mail:vishwavijay@prl.res.in; bhuwan@prl.res.in

Solar type III radio bursts are identified as a rapidly drifting feature in the radio dynamic spectrum. These type III bursts are associated with electron beams that are accelerated to small fractions of light speed (0.1 to 0.3 c) by magnetic reconnection, the process responsible for solar flares. We present a comprehensive study of the prolonged type III radio bursts observed on 9 May 2024. These prolonged, complex type III bursts were associated with the X2.2 class solar flare originating from NOAA AR 13664. At the time of the event, the active region was situated in the heliographic location of S20W24. According to GOES 1-8 Å measurements, the X2.2 flare started around 08:45 UT, peaked at 09:13 UT and ended around 09:36 UT. Notably, the type III radio burst was present from 09:20 UT to 11:00 UT, approximately spanning for ~2 hours, presenting a bright and broader appearance. The type III radio bursts are intriguing due to their prolonged timings and complex substructures. To understand the solar coronal configurations, we have utilized extreme ultraviolet observations from the Atmospheric Imaging Assembly (AIA) on board the Solar Dynamics Observatory (SDO). The observations suggest that the flare is associated with a magnetic flux rope eruption, a set of conjugate flare ribbons, and sustained post-eruptive arcades (PEAs). Importantly, the dense post eruptive arcades were present until ~11 UT. The co-existence of the strong type III bursts along with dense PEAs provides direct evidence of the ejection of the bulk of highly accelerated particles and relativistic electrons from the site of large-scale magnetic reconnection in the solar corona during solar flares. We attempt to address the cause of prolonged and discrete events of magnetic reconnection using multi-wavelength imaging observations and magnetic-field modeling that eventually resulted in a bunch of prolonged and complex structure of type III radio bursts.

Keywords: Prolonged type III radio bursts, Solar flare