Evolution of Flare-accelerated Electrons in the Solar Corona and Chromosphere Revealed by Spatially Resolved Microwave and Hard X-Ray Analysis

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Hard X-ray (HXR) and microwave (MW) observations are highly complementary for studying electron acceleration and transport processes in solar flares. In recent years, a new effort has been made in the MW domain using new high-resolution, multifrequency data from The Expanded Owens Valley Solar Array (EOVSA) and a breakthrough numerical modeling infrastructure that enables us to study properties of high-energy electrons in unprecedented cadence and quantitative detail. This study introduces the observation of an M1.2 flare that occurred on 2017 September 9 and analyzes the evolution of the nonthermal electrons in the corona based on EOVSA MW spectral imaging data. We find a significant spectral hardening of the MW emitting nonthermal electron population in the corona, using EOVSA lower-frequency (<7 GHz) observations over a selected 4-minute window of the flare's impulsive phase. We compare this spectral evolution with the evolution of the spectral index of nonthermal electrons emitting in the chromosphere, derived from HXR observations from the Reuven Ramaty High Energy Solar Spectroscopic Imager. We discuss the general picture of the evolution of the nonthermal electron population in this flare by incorporating observations at the two complementary wavelengths. We also make an estimate of the total energy of the nonthermal electrons contained in the observed coronal low-frequency MW source and discuss its temporal evolution.