Energy budget of cold solar flares

G.G. Motorina

Central Astronomical Observatory at Pulkovo of Russian Academy of Sciences, St. Petersburg, Russia
Space Research Institute of Russian Academy of Sciences, Moscow, Russia

Solar flares exhibit significant diversity in the energy distribution between thermal, non-thermal, and kinetic components. The so-called “cold” solar flares, which are characterized by a substantial non-thermal component and practically no thermal component, are particularly well suited for studying the direct effect of non-thermal electrons on plasma heating. Thus, the present work aims to analyze the ratio of thermal and non-thermal energy and their evolution in cold solar flares, in particularly, solar flare SOL2017-09-07T184140 (C4.5). This flare is the first cold flare for which there are EOVSA observations, and hence it is possible to dynamically measure the coronal magnetic field and other parameters at the flare localization site. To estimate the thermal component, we analyzed the differential emission measure based on SDO/AIA data. Using Fermi/GBM data fitting, estimates of the hot plasma component and the non-thermal component were made. To test the hypothesis about the flare morphology, a 3D model was created using a GX simulator based on SDO/HMI, microwave (EOVSA), and X-ray (Fermi/GBM) data. The obtained results suggest that the non-thermal energy released during the microwave burst is sufficient for the thermal response of the flare, similar to other cold flares.

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