Contribution ID: **273** Type: **not specified**

A New Component from the Quiet Sun from Radio to Gamma Rays: Synchrotron Radiation by Galactic Cosmic-Ray Electrons

Monday, 11 September 2023 16:30 (15 minutes)

The quiet Sun, i.e., in its nonflaring state or nonflaring regions, emits thermal radiation from radio to ultraviolet. The quiet Sun also produces nonthermal radiation observed in gamma rays due to interactions of Galactic cosmic rays (GCRs) with the solar atmosphere and photons. We report on a new component: the synchrotron emission by GCR electrons in the solar magnetic field. To the best of our knowledge this is the first time this emission has been theoretically claimed and modeled. We find that the measured GCR electrons with energies from tens of GeV to a few TeV produce synchrotron emission in X-rays, which is a few orders of magnitude lower than current upper limits of the quiet Sun set by RHESSI and FOXSI, with no energy losses included. For a radially decreasing solar magnetic field we find the expected synchrotron intensity to be almost constant in the solar disk, to peak in the close proximity of the Sun, and to quickly drop away from the Sun. We also estimate the synchrotron emission from radio to gamma rays, and we compare it with current observations, especially with LOFAR. While it is negligible from radio to UV compared to the solar thermal radiation, this emission can potentially be observed at high energies with NuSTAR and more promising future FOXSI observations. This could potentially allow for constraining GCR densities and magnetic-field intensities at the Sun. This study provides a more complete description and a possible new way for understanding the quiet Sun and its environment. Based on Orlando, Petrosian, Strong (2023) ApJ 943, 173

Primary author: ORLANDO, Elena

Co-authors: PETROSIAN, Vahe'; STRONG, Andrew

Presenter: ORLANDO, Elena

Session Classification: CCR: Charged Cosmic Ray

Track Classification: Charged Cosmic Rays