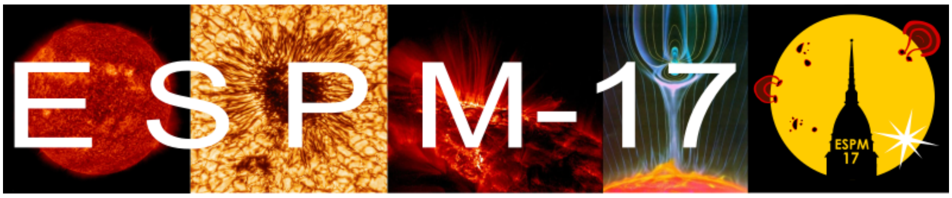

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Estimating the total energy content in escaping accelerated solar electron beams

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Quantifying the energy content of accelerated electron beams during solar eruptive events is a key outstanding objective that must be constrained to refine particle acceleration models and understand the electron component of space weather. Previous estimations have used in situ measurements near the Earth, and consequently suffer from electron beam propagation effects. In this study, we deduce properties of a rapid sequence of escaping electron beams that were accelerated during a solar flare on 22 May 2013 and produced type III radio bursts, including the first estimate of energy density from remote sensing observations. We use extreme-ultraviolet observations to infer the magnetic structure of the source active region NOAA 11745, and Nançay Radioheliograph imaging spectroscopy to estimate the speed and origin of the escaping electron beams. Using the observationally deduced electron beam properties from the type III bursts and co-temporal hard X-rays, we simulate electron beam properties to estimate the electron number density and energy in the acceleration region. We find an electron density (above 30 keV) in the acceleration region of 10^3 cm^-3 and an energy density of 5.74x10^-5 erg cm^-1. Radio observations suggest the particles travelled a very short distance before they began to produce radio emission, implying a radially narrow acceleration region. A short but plausibly wide slab-like acceleration volume of 10^26-10^28 cm^3 atop the flaring loop arcade could contain a total energy of 10^24-10^25 erg (~100 beams), which is comparable to energy estimates from previous studies.

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