Estimates of Densities and Filling Factors from a Cooling Time Analysis of Solar Microflares Observed with RHESSI

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(Submitted on 20 Jul 2011)

We use more than 4,500 microflares from the Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI) microflare data set (Christe et al., 2008, Ap. J., 677, 1385) to estimate electron densities and volumetric filling factors of microflare loops using a cooling time analysis. We show that if the filling factor is assumed to be unity, the calculated conductive cooling times are much shorter than the observed flare decay times, which in turn are much shorter than the calculated radiative cooling times. This is likely unphysical, but the contradic- tion can be resolved by assuming the radiative and conductive cooling times are comparable, which is valid when the flare loop temperature is a maximum and when external heating can be ignored. We find that resultant radiative and con- ductive cooling times are comparable to observed decay times, which has been used as an assumption in some previous studies. The inferred electron densities have a mean value of 10^11.6 cm^-3 and filling factors have a mean of 10^-3.7. The filling factors are lower and densities are higher than previous estimates for large flares, but are similar to those found for two microflares by Moore et al. (Ap. J., 526, 505, 1999).

Comments:	Published in Ap. J
Subjects:	**Solar and Stellar Astrophysics (astro-ph.SR)**
Journal reference:	Ap. J., 736, 75, 2011 July 20
DOI:	10.1088/0004-637X/736/1/75
Cite as:	**arXiv:1107.3997 [astro-ph.SR]**
	(or **arXiv:1107.3997v1 [astro-ph.SR]** for this version)

Submission history

From: Robert Baylor [view email]
[v1] Wed, 20 Jul 2011 15:08:55 GMT (157kb)

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