# What Causes The Increasing Submillimeter Spectral Component Of Solar Flares?



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The flare on November 2nd, 2003, at 17:17 UT, occurred on the very active region 486 located at S14W56. This X8.3 flare was simultaneously detected by RHESSI and the Solar Submillimeter Telescope (SST) at 212 and 405 GHz. The time profile of the submm emission resembles that of the high energy X-rays observed by RHESSI and the microwaves observed by OVSA. Moreover, the centroid position of the submm radiation is seen to originate within the same flaring loops of the ultraviolet and X-rays sources. Nevertheless, the submm spectra are distinct from the usual microwave spectra, showing a flux density increase with frequency. Three possibilities to explain this increasing radio spectra are discussed: (1) bremsstrahlung from thermal electrons, (2) gyrosynchrotron radiation from accelerated electrons, and finally (3) gyrosynchrotron emission from the positrons produced by pion or radioactive decay after nuclear interactions. It is possible to model the emission as thermal, the problem, however, is to explain the good agreement of the submm temporal profile with those of the non-thermal emission seen in microwaves and hard X-rays. If the submm emission is to be explained by gyrosynchrotron from the same population of accelerated electrons that emit hard X-rays, however, a discrepancy of 300 times more electrons between 40 keV and 20 MeV is found between the fit to the high frequency radio spectra and what was observed by RHESSI, even for a 3000 G field. Finally, synchrotron emission from positrons requires 3.3 - 10 × $10^5$ more positrons than what is inferred from X and gamma-ray observations, thus ruling this out as a possible explanation. In summary, all possibilities listed above run into problems when trying to explain the increasing submm spectra, because of the extreme source parameters required. Therefore, the cause of this new component still remains unknown.

**Publication:**
American Astronomical Society Meeting 210, id.37.05; Bulletin of the American Astronomical Society, Vol. 39, p.151

**Pub Date:**
May 2007

**Bibcode:**

2007AAS...210.3705S