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Detection of radio emission from fireballs with the MWA

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1 Extended Abstract

When meteors pass through the atmosphere, they are heated to ablation and create ionized trails. These trails have been studied for decades, and they are long known to reflect radio signals. However, for a long time people were not able to identify any intrinsic radio emission from the ionized trails. Recently in a search for prompt low frequency emissions from Gamma Ray Bursts (GRBs) using the LWA, two interesting transients were reported not coincident with any known GRBs [1]. Further observations revealed some transients correlating with fireballs, both spatially and temporally [2]. These transients correlating with fireballs are different from the well-studied radio echoes of meteor trails in polarization, spectra, power profiles and spatial distribution. Thus the LWA team suggested that they observed the intrinsic radio emission from fireballs.

Based on the LWA team's results, we carried out observations of meteors with the Murchison Widefield Array (MWA) [3], and compared our results with optical images from the Desert Fireball Network (DFN). Consisting of 128 aperture arrays scattered in a 3 km diameter area in Western Australia, the MWA has some advantages in meteor observation, like high spatial resolution and high time resolution. In our research, we used a low frequency band (72 - 103 MHz) to observe meteors. The top half of this band is in the FM radio band of Australia, while the bottom half is outside it. Thus we can observe reflection and intrinsic emission from meteor trails at the same time. Up to now, we have discovered one possible meteor candidate with intrinsic radio emission.

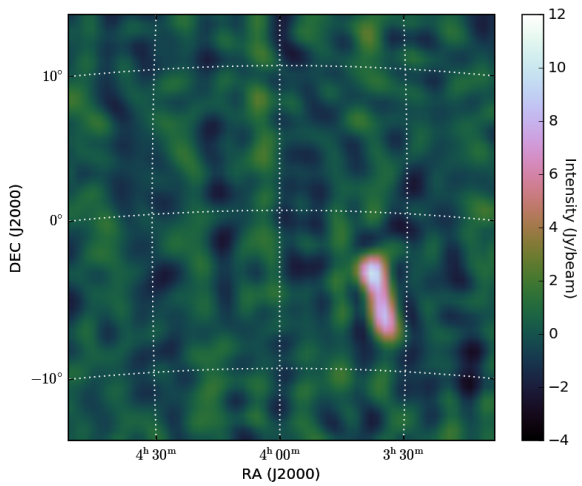

Figure 1. A possible meteor candidate with intrinsic radio emission as observed by the MWA. Image is integrated over 8 seconds. The strong constant sources like the Galactic plane are removed by subtraction.

References

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