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Study of the Particle Acceleration and Heating in a Weak Solar Flare using JVLA

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Solar flares are sudden and massive releases of magnetic energy in the corona. As a consequence, particles are efficiently accelerated to high energies and plasma is heated up to tens of millions K **[1]**. However, this phenomenon is dynamically and morphologically complex. A characteristic of this complexity is the creation of multiple acceleration sites due to the magnetic field reconfiguration. During the flare, the energetic electrons propagating in the loops emits in high-frequency radio wavelengths via gyrosyntrochton emission mechanism **[2]**. Some class of energetic particles may undergo plasma instabilities producing intense coherent radio emission **[3]**. Accelerated electrons and hot plasma also produce X-ray bremsstrahlung. The heated plasma filling the magnetic loops show up as bright emissions in various extreme ultra-violet (EUV) wavelengths. This entire flare process shows complex evolution at fine spatial, spectral and temporal scales. Therefore, a more comprehensive understanding of solar flares requires multi-wavelength analysis with observations that provide high spatial resolution coupled with high frequency and time resolution.

With modern instrumentation, the Jansky Very Large Array (JVLA) provides an opportunity to study solar flares using the broadband imaging spectroscopy at a high spatial resolution **[4]**. We present an analysis of a GOES B-class flare observed by JVLA on 25th Feb 2012, 20:40 UT to 21:00 UT at 1-2 GHz. This event, despite its small size, displayed a complex morphology with many loop systems suggesting multiple accelerations sites. We perform an event study focusing on the energetics and dynamics of the particle acceleration and heating during this flare. The JVLA observations were coupled with simultaneous X-ray observations from Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI) and EUV observations from Solar Dynamic Observatory (SDO). These observations, along with the modelling by gyrosynchroton emission, provide a detailed view of the plasma heating and particle acceleration as a function of space and time.

References

1. Hudson HS: 2011, Global properties of solar flare, *Space Sci Rev*, 158:5-41.
2. Bastian T.S., Benz A.O. & Gary D.E. : 1998, *Annual Review of Astronomy and Astrophysics*, 36:1, 131-188
3. Dulk G. A. : 1985, Radio emission from the sun and stars, *Annual Review of Astronomy and Astrophysics*, 23:169–224
4. Chen B. *et al* : 2013, Astrophysical Journal Letters, 763:L21 (6pp)