

Radio Flares from Massive Magnetic Stars

Stars with extremely strong magnetic fields (at least 100 times that of our Sun) can produce extremely powerful flares that are detectable across the electromagnetic spectrum, from the radio band and all the way up to X-ray and gamma-ray wavelengths. Our interest in studying such flares stems from our desire to learn how they physically and chemically impact planet formation and habitability. These studies also provide insight into magnetic reconnection processes that are far more extreme than those seen from our Sun. Historically, most low frequency flare star studies have targeted very low mass magnetic stars, such as M dwarfs, with the aim of tracing exotic processes associated with magnetic fields that produce nearly 100% circularly polarised (known as coherent) radio emission. However, recent low frequency studies conducted with the Giant Metrewave Radio Telescope (GMRT) at 610 MHz have detected similar coherent emission associated with massive magnetic stars (see Figure below). Such detections have huge implications on how strong magnetic fields effect the evolution and final supernova of massive stars.

Research Field

Radio Astronomy

Project Suitability

Honours

Project Supervisor

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Co-Supervisors

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For this project, you will use the Murchison Widefield Array (MWA) to study low frequency radio flares produced by massive, young and rapidly rotating magnetic stars that are destined to go supernova. These studies will form the basis of a new collaboration with GMRT observers. MWA observations collected between 100-200 MHz will be combined with GMRT observations taken between 300 MHz and 1.4 GHz in order to directly probe the transition between different low frequency, coherent emission mechanisms, and will be the first combined low frequency study of massive magnetic stars. Using these techniques to directly probe the magnetic fields in massive stars will allow us to understand the role they play in stellar explosions.

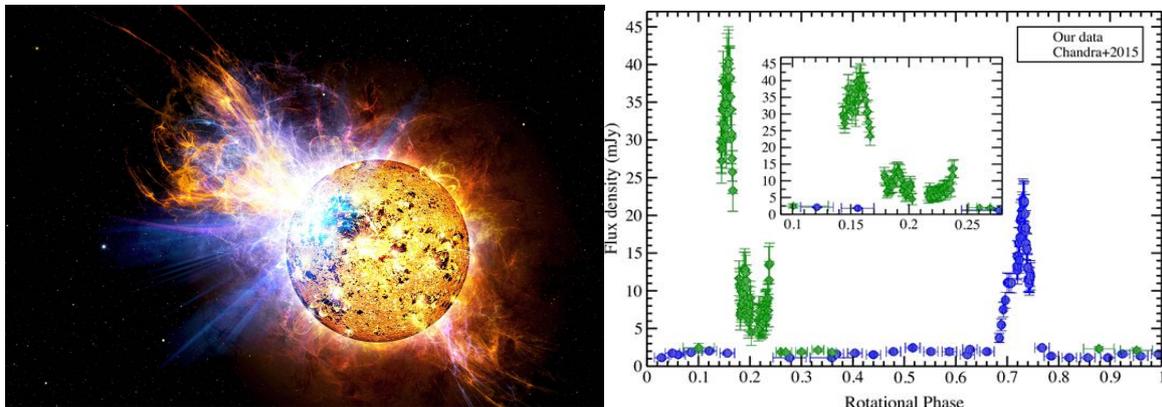


Figure – Left: Artist's impression of flare star (Casey Reed/NASA), Right: GMRT detections of radio flares at 610MHz as a function of the rotation phase of the massive star HD 138880 (Das et al. 2018).