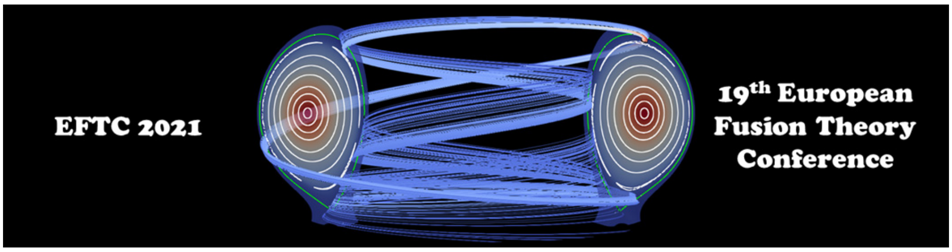

Contribution ID: **58** Type: **Invited**

Modelling energetic particles in solar and stellar flares

Thursday 14 October 2021 10:00 (40 minutes)

Solar flares are the most powerful explosions in the solar system, and are widely accepted to result from release of stored magnetic energy through magnetic reconnection. Many aspects of flare physics remain poorly understood: in particular, the large numbers of high-energy electrons and ions, forming a non-thermal element of the energy distribution, which can be the predominant energy release channel. Understanding the acceleration and transport of these non-thermal particles is a challenge for plasma physics theory, and a comprehensive model must account for both the global magnetic field structure on length-scales of around 10 –100 Mm, and the plasma kinetic processes associated with energy dissipation and particle acceleration, on scales as small as 1 cm (electron gyro-radius). I will outline our current knowledge of energetic particles in flares based on Hard X-ray and radio observations, and the mechanisms which are proposed to explain their origin. Then I will focus on a scenario for confined solar flares, in which reconnection and energy release are triggered by the kink instability in twisted coronal loops, with distributed particle acceleration in fragmented current sheets. A forward-modelling approach predicts observable emissions associated with both thermal and non-thermal plasma in this scenario, and provides a means potentially to detect twisted magnetic fields in the corona. Building on this approach, it has recently been shown that an individual flaring event can be effectively modelled using a combination of 3D magnetohydrodynamic and kinetic (test particle) simulations, giving good agreement with observations. This allows modelling of the escape of energetic particles into the heliosphere, an important issue for space weather prediction. Many other stars also exhibit flares, and flares in young stars, known as T-Tauri stars, can be especially vigorous. I will describe a recent model for the radio and X-ray emission in T-Tauri flares, building on current understanding of solar flares, in which non-thermal particles generated by star-disk interaction populate large loops. Finally, I will discuss the outstanding unsolved problems in this area, and suggest some directions for future work, including some synergies with fusion plasmas.

Author: BROWNING, Philippa (University of Manchester, UK)

Presenter: BROWNING, Philippa (University of Manchester, UK)

Session Classification: ORAL SESSION

Track Classification: 5. Burning plasmas and fast particles