Modelling X-ray and radio emission from a flaring T–Tauri star

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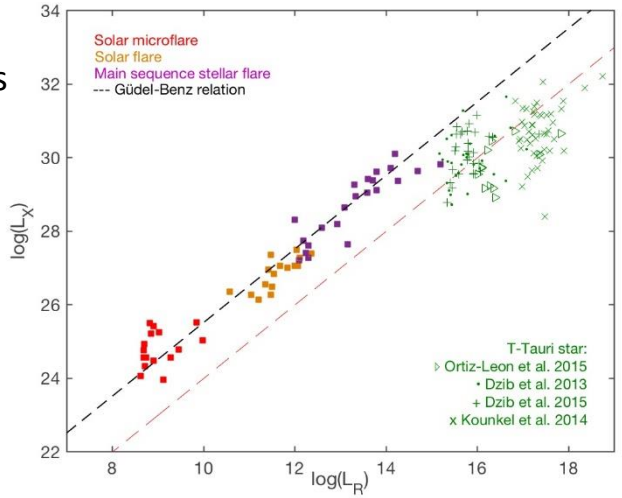
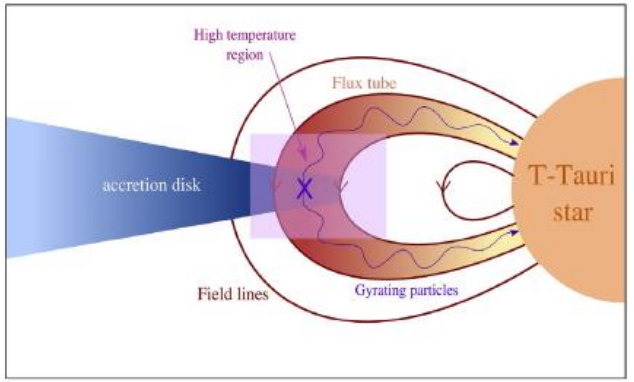
Waterfall et al MNRAS 483, 917 (2019)
Waterfall et al MNRAS 496, 2715 (2020)

The University of Manchester

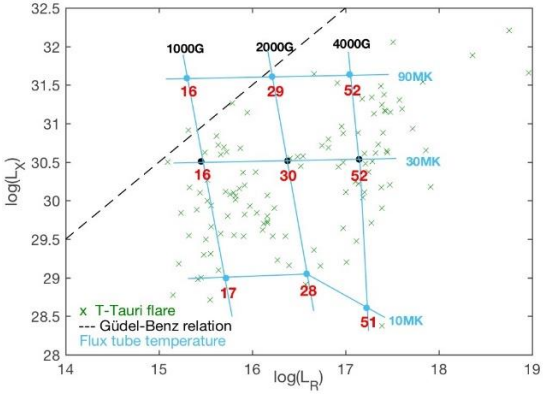
- T-Tauri flares much more luminous than solar flares
- Strong nonthermal emission - large magnetic reconnection events
- Radio emission due to gyrosynchrotron emission from non-thermal electrons in strong magnetic fields
- We model radio emission using fast GS codes (Kutnetsov et al 2011)



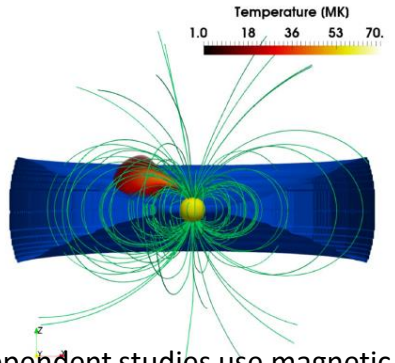
T-Tauri stars deviate significantly from Gudel-Benz relation between X-ray and radio luminosity



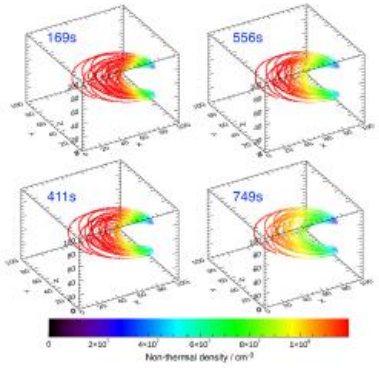
Inner disk radius ranges from 4-10R_*, interaction with large magnetic loops likely – we assume large magnetic loop filled with nonthermal electrons



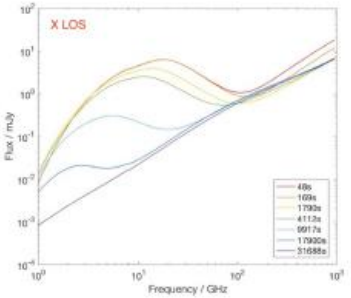
Modelled radio and X-ray emission in static stellar magnetic field/atmosphere model for range of parameters (here magnetic field and loop temperature) – matches observations



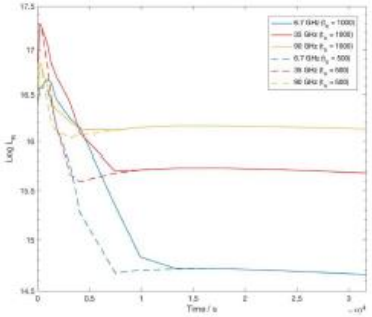
Time-dependent studies use magnetic fields, temperatures and densities from 3D MHD simulations of flare (Orlando et al 2011)



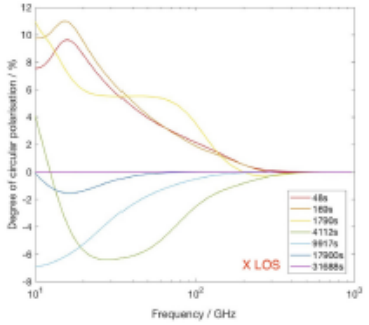
Fieldlines intercepting flaring region are populated with distribution of non-thermal electrons



Predicted radio spectra at successive times (for line of sight along x)



Predicted radio and X-ray lightcurves



Predicted degree of circular polarization as a function of frequency at successive times (for line of sight along x)