MASS ACCRETION ONTO T TAURI STARS. S. G. Gregory, M. Jardine, I. Simpson, A. Collier Cameron, *School of Physics and Astronomy, University of St Andrews, St Andrews, KY16 9SS, UK, (sg64@st-andrews.ac.uk)*, J. -F. Donati, *Laboratoire d'Astrophysique, Observatoire Midi-Pyrénées, 14 Av. E. Belin, F-31400 Toulouse, France*.

It is now accepted that accretion onto classical T Tauri stars (CTTSs) is controlled by the stellar magnetosphere, with mean surface fields of 1-3kG having been detected in a number of different stars [1]. To date most accretion models have assumed that their magnetic fields are dipolar [2], however there is recent evidence which suggests that the magnetic fields of CTTSs are highly complex, particularly close to the stellar surface [1]. Such strong fields disrupt the circumstellar disk and channel in-falling material onto the star.

In order to determine the influence on accretion of magnetic fields with a realistic degree of complexity, we extrapolate fields from surface magnetograms of young main sequence stars. From Zeeman-Doppler imaging the field is reconstructed using the potential field source surface method [3]. We find that the field geometry has a significant effect in controlling the location and distribution of hot spots, formed on the stellar surface from the high velocity impact of accreting material. Accreting field line foot points are often at mid to low latitudes, in contrast with the higher latitudes obtained when considering accretion to a dipole, with accreting filling factors of typically a few percent. Fig. 1 shows one example of the realistic magnetic field structures that we consider.

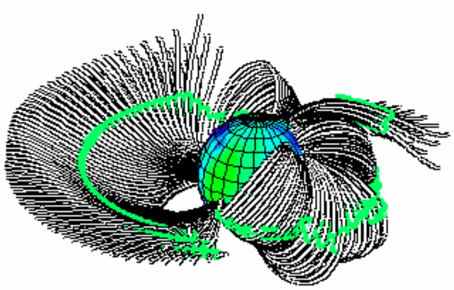

Figure 1: An example accreting field extrapolation showing magnetic field lines that may carry an accretion flow. Points indicate where the field lines thread a thin circumstellar disk.

We have used our accretion model to reproduce the observed correlation between mass accretion rate and stellar mass, originally noted by [4]. This correlation was found to extend to very low mass CTTSs [5] and to the higher mass intermediate mass T Tauri stars by [6], who obtain the correlation $\dot{M} \propto M_*^{1.95}$. By considering a simple steady state accretion model with a static magnetosphere we reproduce this correlation, see Fig. 2. At any particular stellar mass there can be a couple of orders of magnitude difference in the calculated mass accretion rate, depending on the other stellar parameters (radius, rotation period and coronal temperature), with the structure of the magnetic field also being significant. We have used published data for CTTSs, including data from the COUP database [7].

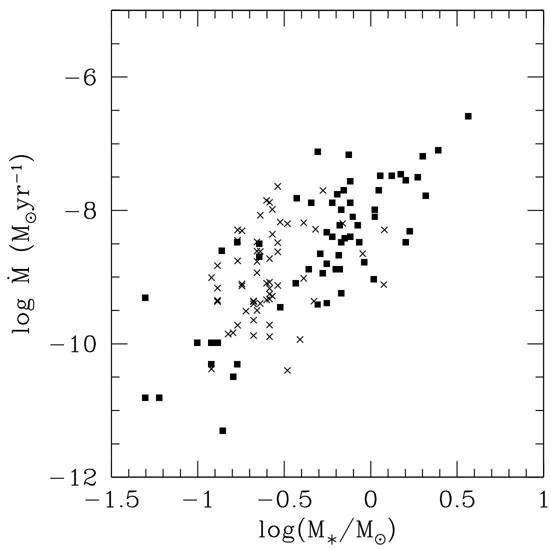

Figure 2: The correlation between mass accretion rate and stellar mass. Data is taken from Fig. 17 of [6; *squares*], which is a collection of observational data from [4], [5], [6] and [8]. Using data from the COUP sample of accreting stars [7] our accretion model produces a similar correlation (*crosses*).

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