

Ages of Young Stars and the Evolution of Dynamo-Generated Magnetic Fields

Stars with masses below 5 solar masses begin their lives

Purpose and Aims

Survey of the Field

- Age-dating problems for young stars. (i.e., model inconsistencies)
- Identification / inclusion of magnetic fields in models. (D'Antona, MacDonald, Feiden)
- Magnetic field observations. (e.g., MDI, ZDI)
- Open questions.

Project Description

Dynamo-Generated Magnetic Fields throughout Early Stellar Evolution

Magnetic Inhibition of Convection, Starspots, and Atmospheric Properties

Improved treatment of surface boundary conditions through incorporation of detailed frequency-dependent radiative transfer. Seek to answer: How are surface boundary conditions affected by magnetic inhibition of convection, and how do they affect interior structure? How do starspots affect observational properties of young stars?

Core Convection in the Presence of Magnetic Fields

Magnetic Fields in Young Brown Dwarfs and Giant Planets

Investigating the generation and impact of magnetic fields in cool, high density plasmas. Finite electrical conductivity becomes a significant factor. Seek to answer: Is the contraction time of young brown dwarfs and giant planets affected by magnetic fields?

Significance

Young stellar ages → protoplanetary disk evolution timescale thus giant planet formation timescale; star formation history, including mass distribution (IMF); mass distribution of directly imaged planets / brown dwarfs.

Preliminary Results

Feiden (2016, submitted).

Pilot study showing results for the Sun (and a low-mass star?).

Independent Line of Research

International and National Collaborations

Observational Campaigns:

- Kraus, Rizzuto, Mann (UT Austin) – B- through M-type EBs in young associations with K2 & magnetic fields of young stars with IGRINS.

- Kochukhov (Uppsala), Hussain (ESO) – magnetic field topologies (MDI/ZDI) of young stars.

Other Grants