# The Mean Magnetic Field of HD 113816

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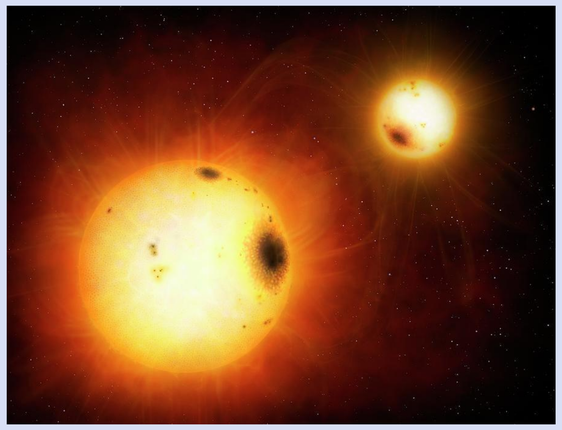
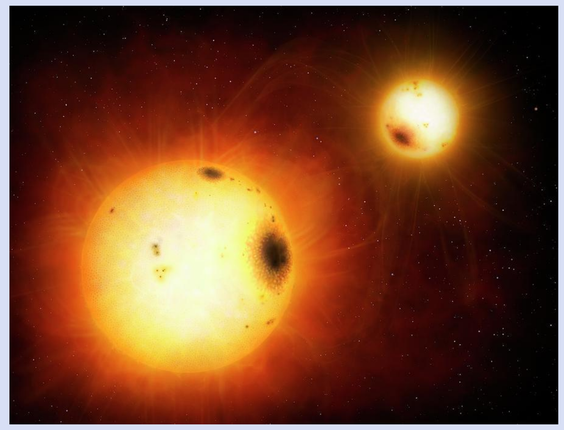


graphic by Mark Garlic

## Summary

HD 113816 (IS Vir) is a K0 III RS CVn star. We use high resolution K band spectra obtained with the CHSELL spectrometer to measure the mean magnetic field across the stellar surface. Four strong Ti I lines provide significant sensitivity to magnetic fields, while several magnetically insensitive CO lines provide a check on all other line broadening mechanisms. Our initial analysis reveals a mean field of ~1 kG across the entire stellar surface. We discuss the implications of this measurement.



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## Motivation

- Stellar magnetic fields are critical for many aspects of stellar evolution
- The fields are dynamo generated, though dynamos are not well understood
- RS CVn stars are rapidly rotating post-main sequence (subgiant) stars
- Simple dynamo models predict RS CVn fields should be similar in strength to young T Tauri stars (also rapidly rotating subgiants)
- T Tauri star fields are well measured, so we have begun a program to measure fields on RS CVn stars to test this basic prediction

## Experiment

- HD 113816 is a K0 RS CVn star with a low vsini
- We observed 4 magnetically sensitive Ti I lines plus 9 magnetically insensitive CO lines in the K band using CSHELL at the IRTF
- We fit magnetic and non-magnetic models shown in the figure below (Fig. 1) to derive a mean magnetic field of 1.01 ± 0.10 kG on the stellar surface

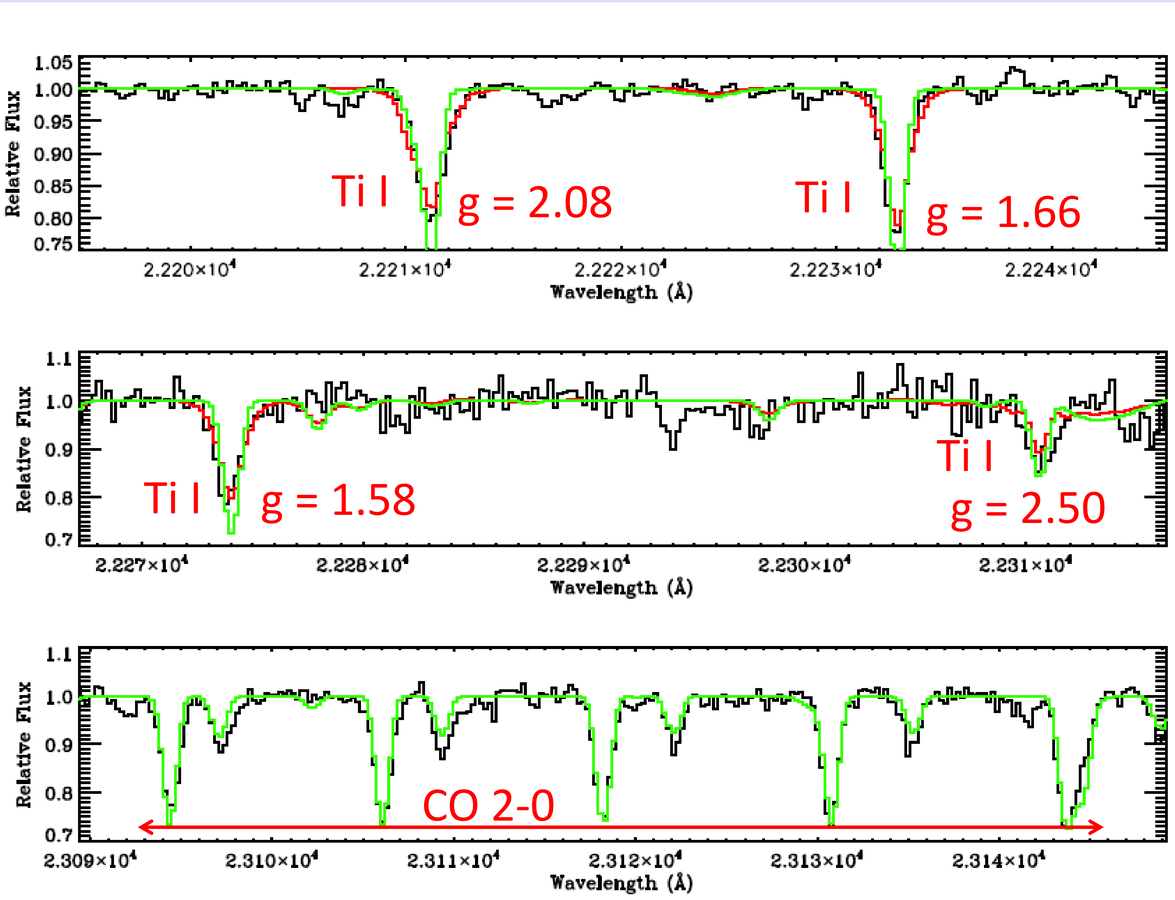


Figure 1: CSHELL spectra of HD 113816 shown in black. The top 2 panels show magnetically sensitive Ti I lines (Lande-g values given). The bottom panel shows magnetically insensitive CO lines. The green curve shows a non-magnetic model showing how narrow all lines should be. The red profile shows the magnetic model demonstrating the Zeeman broadening in the Ti I lines. All models are computed with SYNTHMAG (Piskunov 1999).

## Interpretation

- Figure 2 (below) shows the mean field of HD 113816 compared to the mean field of several other stars, including several T Tauri stars (solid black circles)
- The smooth lines on Figure 2 with gravities labelled give predicted field strengths in pressure equipartition with the quiet photosphere
- The gravity of HD 113816 is log = 2.65 (Katz et al. 2003)
- The mean field of HD 113816 is much stronger than the equipartition field, but lower than the average T Tauri star field
- HD 113816 is the first of a sample of about a dozen RS CVn stars we will analyze – while no firm results can be drawn from this sample of 1, these observations suggest the field of HD 113816 may be weaker than expected given that RS CVn stars and T Tauri stars should have similar dynamo properties

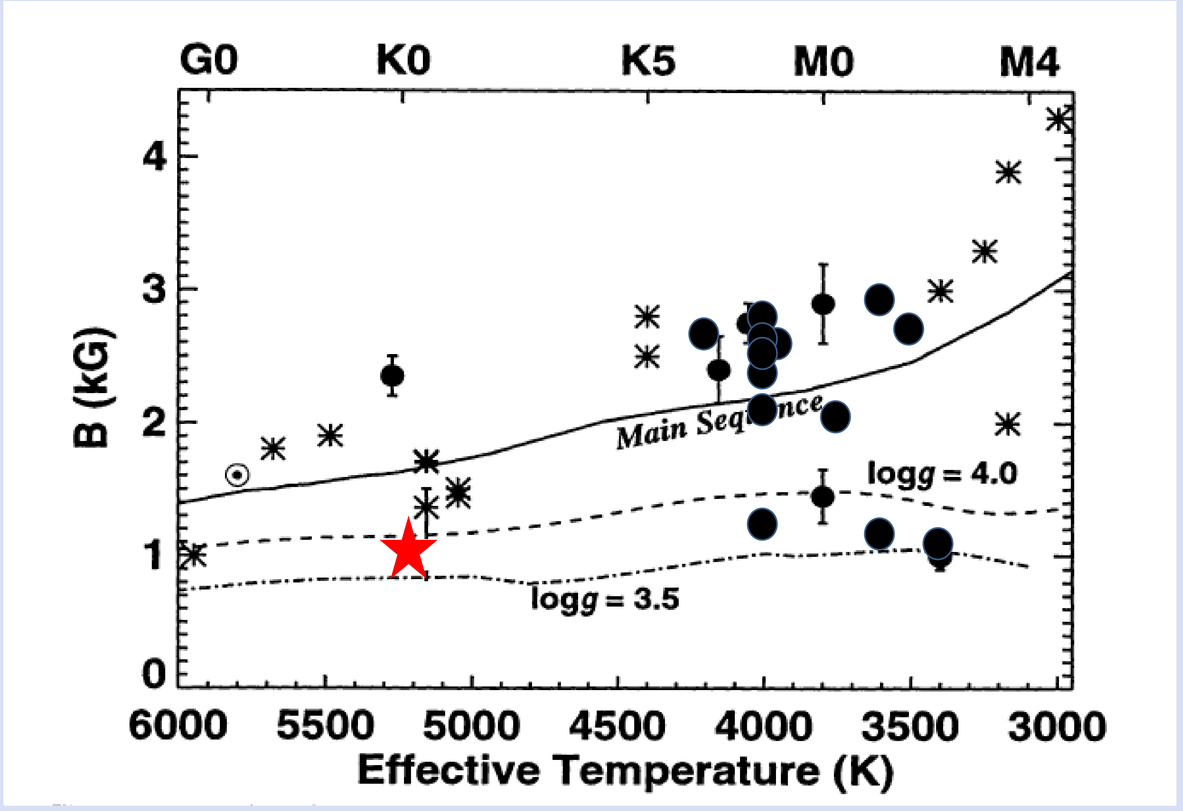


Figure 2: Stars with magnetic field measurements: asterisks – main sequence stars; solid circles – T Tauri stars; red star – HD 113816. Field measurements come from Johns-Krull & Valenti (2000) and Johns-Krull (2007). The strength of solar plage regions also shown. Smooth lines denote predicted equipartition field strengths.

**References**

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Katz, D. et al. 2003, A&A, 397, 747
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**Acknowledegements:** NSF grant AST-1461918 and NASA grant 80NSSC18K0828