Studying the magnetic fields of young cool stars

from near-infrared spectroscopy

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All the details in **Lavail et al. 2019**; **Lavail et al. 2017**. arXiv:1909.04965 arXiv:1711.05143 https://github.com/astro-alexis/magnotron-tts

Alexis Lavail
Uppsala University
alexis.lavail@physics.uu.se
http://aalex.is

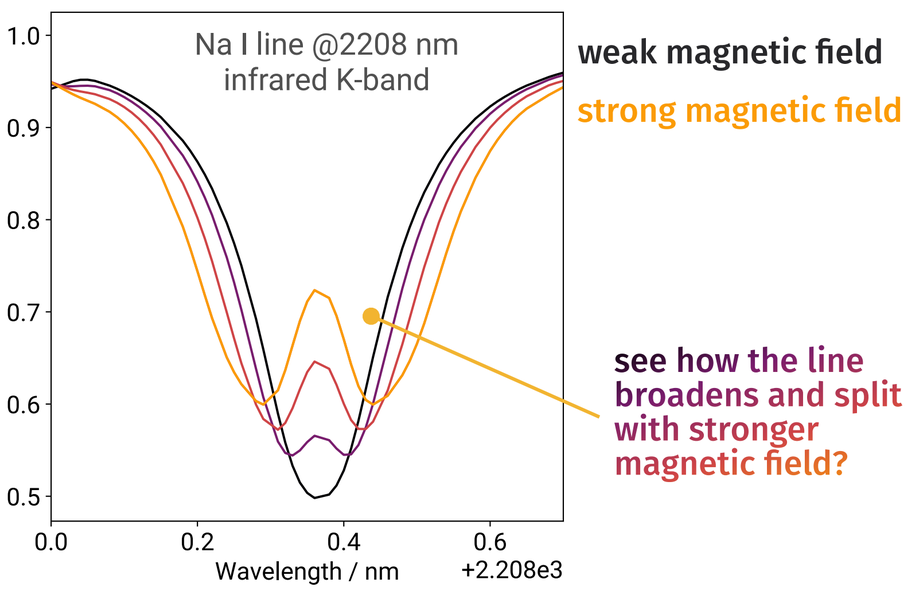
1. How do we observe stellar magnetic fields?

Magnetic fields leave an inprint in stellar light via the Zeeman effect:

a. some **spectral lines** in intensity spectra **become broader or split** into several lines. **The longer the wavelength, the stronger the effect** (that's why we go into the infrared).

b. some **spectral lines become polarized**! We can observe them in circular and/or linear polarized light with **spectropolarimeters** (most of them operate in the optical, new ones in the near-infrared).

Zeeman broadening (what we use in this work)



From **Zeeman broadening**, we obtain the **mean unsigned magnetic field strength** averaged over the stellar surface.

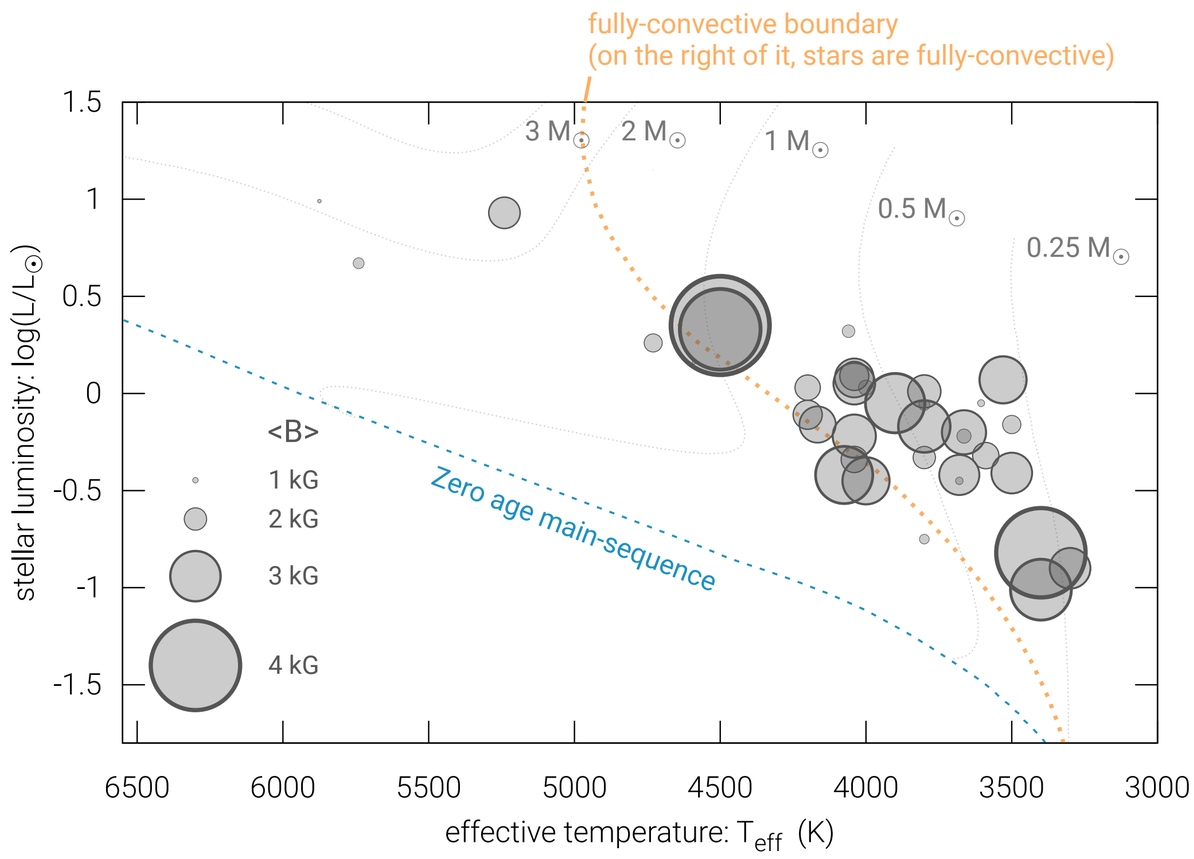
From **polarization**, we can **map the large-scale magnetic field** and learn about its geometry! But a lot of small-scale field (concentrated in spots for instance) cancel out!

The two methods are complementary!

2. Results: magnetic fields of young T Tauri stars

How do magnetic fields evolve on the pre-main-sequence, where stellar structure change? We want to know to understand stellar evolution and dynamo processes better.

Mean magnetic field strengths <B> (own+literature) for T Tauri stars are **plotted on the HR diagram** on the right. For fully convective stars (on the right of the yellow line), the magnetic field strength (symbol radii) can be really different for the same stellar parameters! For hotter stars, we lack observations, but we don't find very strong fields. New instrumentation and observations are coming, so stay tuned! (more details in the papers)



Overview of current and new instrumentation. **In Uppsala, we work on CRIRES+**, which just arrived in Chile, and will be installed on the Very Large Telescope later this year.

https://crir.es