A magnetic field study in the envelope of cool evolved stars

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Abstract:

Evolved cool stars, the future of our Sun, exhibit a massive mass loss, which contributes to enrich the interstellar medium and so contribute to the recycle of the matter in the Universe. The mechanisms (e.g. the stellar magnetic field) behind this mass loss phenomena are not understood, but can be constrained thanks to observations of the star and its circumstellar envelope (CSE). With different radio-wave molecular line emissions, we traced the CSE matter at different radii. In the talk, we will focus on the SiO maser line emission that we recently observed, which probes the inner region of the envelope, up 2-4 stellar radii from the photosphere and can reveal the presence of a magnetic field. It is emitted by small gas cells in the CSE and is strongly polarized. With radio-astronomical observations, we can derive the Stokes parameters I, Q, U, V, and so, some proprieties of the emitted cell environment like the angle of polarization, the linear and circular polarization, which according to theories can lead to an estimated of the magnetic field strength along the line of sight. If there is a magnetic field and if the maser line is saturated, we should observe a Zeeman signature on Stokes V : an "S" shape. Using an *rvm* code, we search this specific pattern in our data. We work with two theories, for the strongly saturated maser and the not strongly saturated maser. In both cases, we can relate the Stokes V to the magnetic field. In our source sample, the magnetic field strength is hence estimated between 0.5 and 3 G. There is still questions about the origin of the magnetic field (solar-type dynamo, turbulent dynamo …) and its evolution that I will address in this talk.