Streams, disk, and chemistry in the S-type AGB star RS Cnc

J.M. Winters[1], T. Le Bertre[2], K.T. Wong[1], D.T. Hoai[3], P.T. Nhung[3], P. Lesaffre[4], P. Tuan-Anh[3], P.N. Diep[3], and P. Darriulat[3]

[1]*IRAM, 300 rue de la Piscine, F-38406 St. Martin d'Hères, France*

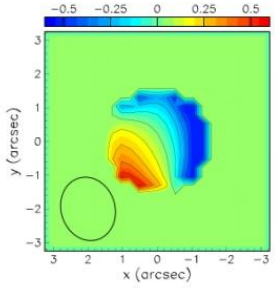
[2]*LERMA, Observatoire de Paris, 61 av. de l'Observatoire, F-75014 Paris, France*

[3]*Vietnam National Space Center, 18 Hoang Quoc Viet, 10000 Ha Noi, Vietnam*

[4]*LPENS, 24 rue Lhomond, F-75231 Paris, France*

Observations of the Asymptotic Giant Branch star RS Cnc have been obtained with NOEMA/PolyFiX in the D-configuration. The PolyFiX data showed, for the first time, many lines of different species: SiO, SO, SO_2, HCN, etc., and confirmed an H_2O line at 232.687GHz previously detected with NOEMA/WideX, plus a second H_2O line at 263.451GHz. In SiO, 5 lines are detected. Although the spatial resolution is only ~1.8'', we find material at velocities higher (10-20 km/s) than the wind terminal velocity of ~8 km/s as traced by CO lines. Higher velocities in SiO than in CO emission have also been seen in the ALMA data of EP Aqr ([1]) and R Dor ([2,3]). The confirmation of this phenomenon in RS Cnc is important as this source offers a unique viewing angle that allows both polar and equatorial material to be observed. Detailed morpho-kinematic analyses will be presented that are only possible with sensitive observations at high spatial and spectral resolution.

In SO_2, 11 lines are detected. The image of stacked SO_2 lines, with a color-coding showing the line-of-sight velocity, is shown in the figure. While the source is barely resolved by the beam (2.1''x1.7''), we see the signature of a rotating structure as in EP Aqr. The spatial resolution in D-configuration is largely insufficient to constrain its size, and to determine whether velocities are compatible with a Keplerian rotation.



New (2D and 3D) hydrodynamic models of stellar winds, including chemistry and magnetic fields are being developed. In a first stage, standard values for the magnetic field (1 Gauss at the level of the photosphere, and a 1/r dependence) are used, with a degree of ionisation of $4\ 10^{-5}$ [4]. These models show that high-velocity streams and rotating structures could result from a toroidal magnetic field.

We will add to our presentation the latest observational results expected to be obtained this winter in NOEMA's A-configuration, providing a spatial resolution of ~0.4".

References

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