Mass transfer in binary stars

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Motivation

Most of the stars are found in binary systems. During their evolution, specially during the AGB phase, the star loses material due to stellar winds; part of this material is accreted by the companion, producing changes in the system.

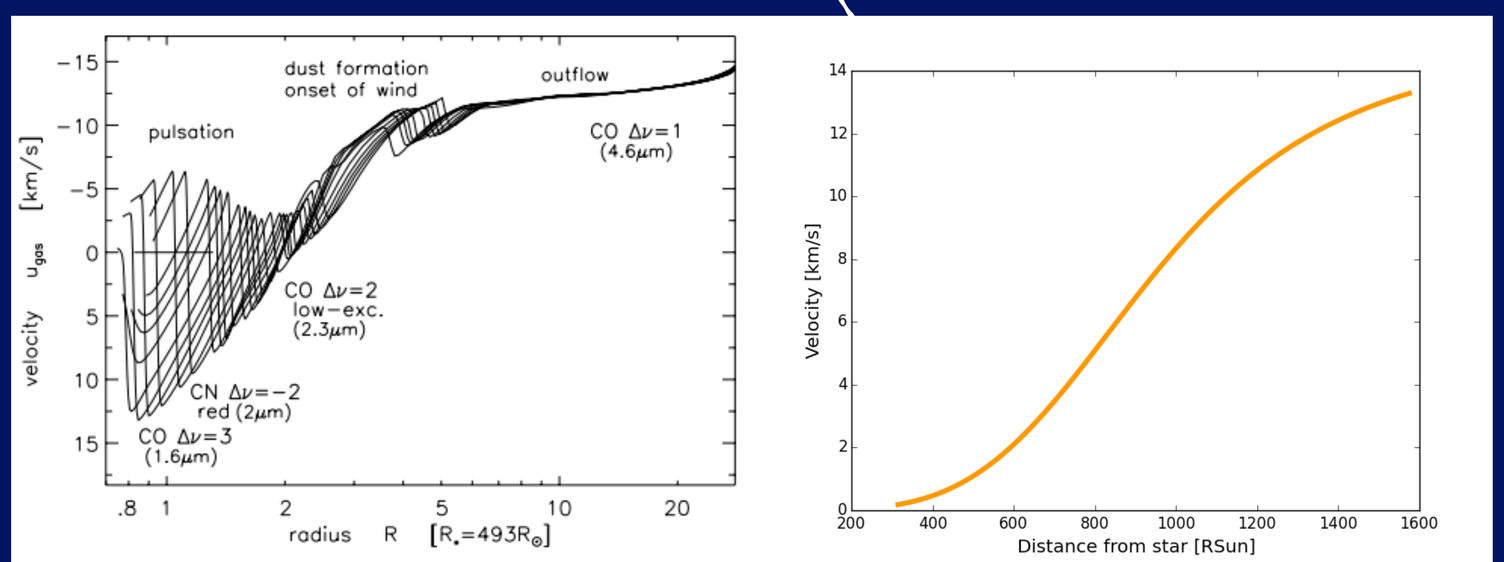
Representation of a binary system. Taken from: http://www.iflscience.com/sites/www.iflscience.com/files/blog/%5Bnid%5D/209608main_keckart_HI.jpg

Aim

We want to investigate the mass transfer in eccentric low-mass binaries to see how the mass accreted by the companion depends on the orbital parameters of the system and how it affects the evolution of the orbits.

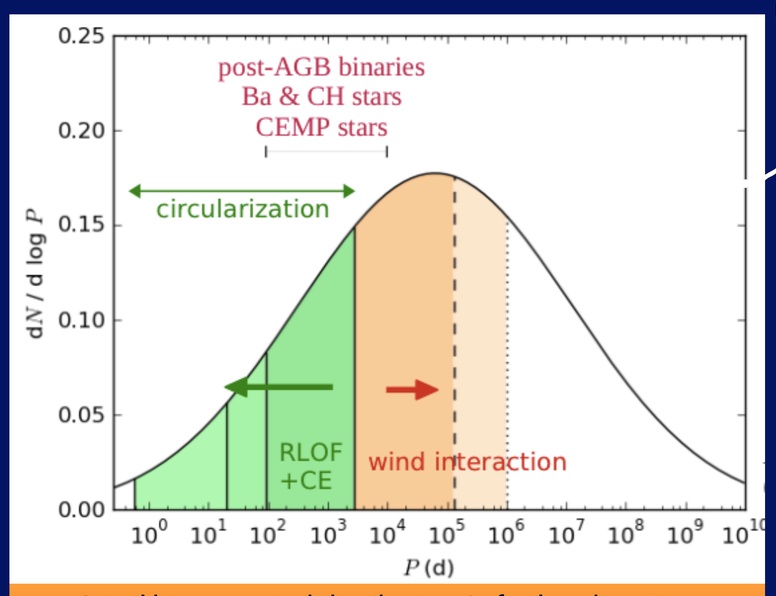
Tools

Using AMUSE [3], we are performing SPH simulations of the outflow material leaving the primary star and by coupling it with gravity codes, we are studying the interaction of the matter with the secondary star.



Left: Model by Nowotny, W. et al. (2005) of the velocity profile of the AGB wind. Right: Analytical profile used in our models.

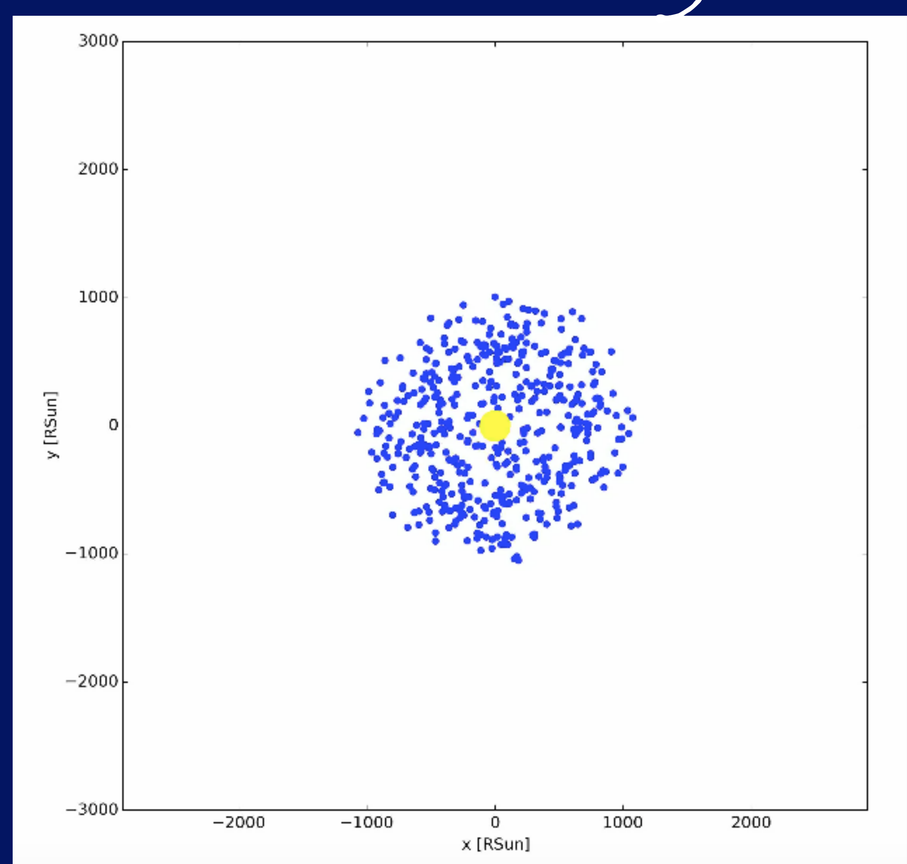
The outflow of matter may occur via different scenarios: Roche lobe overflow or accretion of stellar wind. Observations have shown many evolved binaries at orbital periods of ~1-10 years, where binary evolution models predict a gap in the period distribution. These binaries are usually eccentric. How is this possible?



Initial binary period distribution. Left: close binaries, circularised (tidal forces). Right: wide binaries, not all mass is accreted. Eccentric orbits are observed in the predicted period gap. Taken from Pols. O. Evolution of Low and Intermediate Stars, Ulaanbaatar (2014).

Results

Coming soon....



Simulation of the wind for the primary star (in yellow). The blue particles simulate the wind leaving the star. The mass loss rate is computed using stellar evolution codes.

References

[1] Nowotny, W. et al. (2005), A&A 437, 285–296

[2] Mohamed & Podsiadlowski (2007). Baltic Astronomy, Vol. 16, p.26-33

[3] Portegies Zwart, S., et al. (2009), New Astronomy, Vol. 14, Issue 4, 369-378