AMUSEing winds in binary stars

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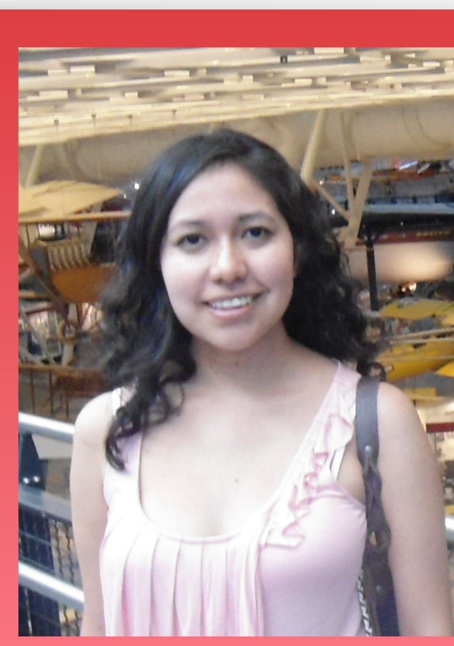
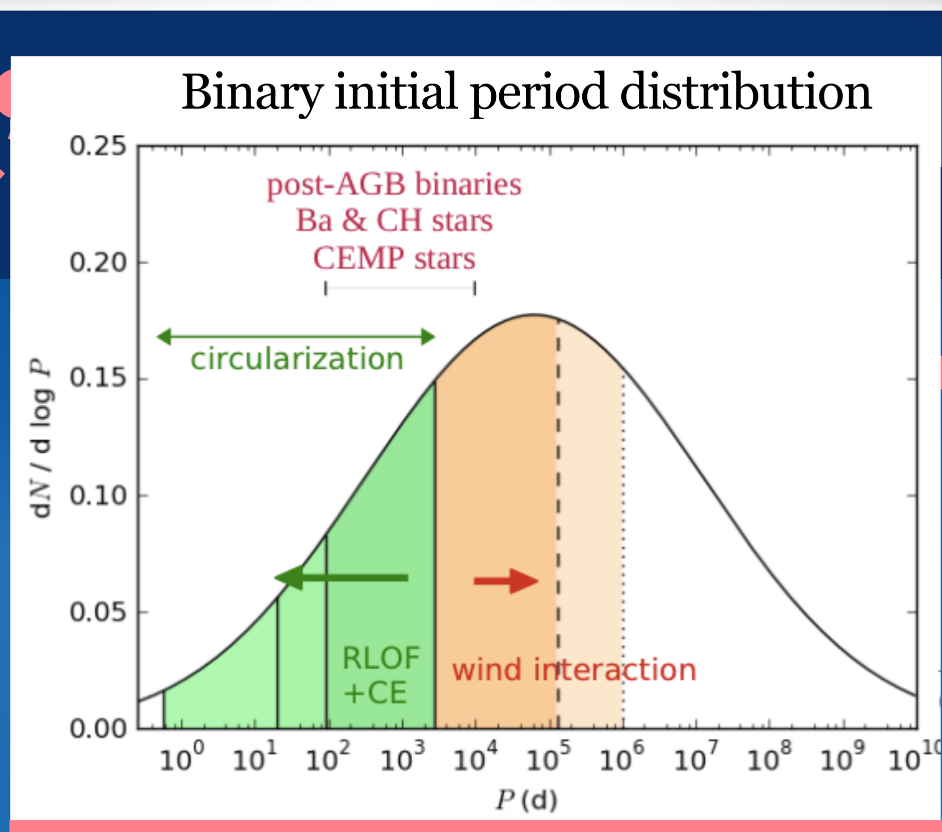


CONTEXT

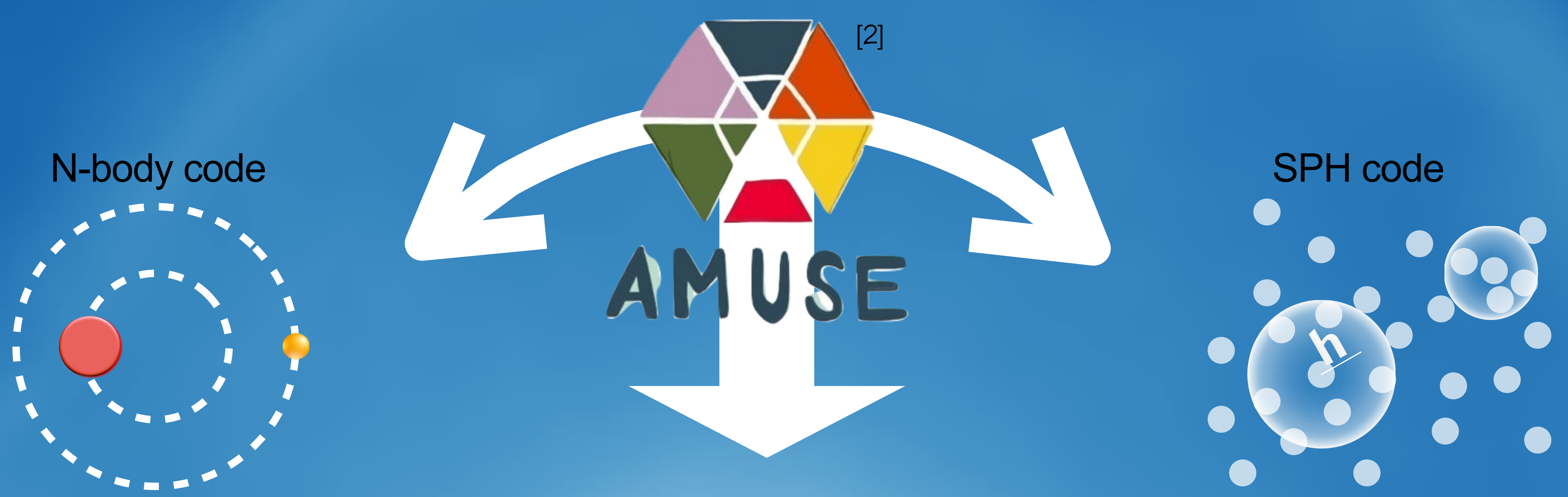
In binary systems where one of the stars is in the AGB phase, mass transfer is likely to occur. Observations have shown that many evolved binaries have periods of 1-10 yr, where binary evolution models predict a gap.

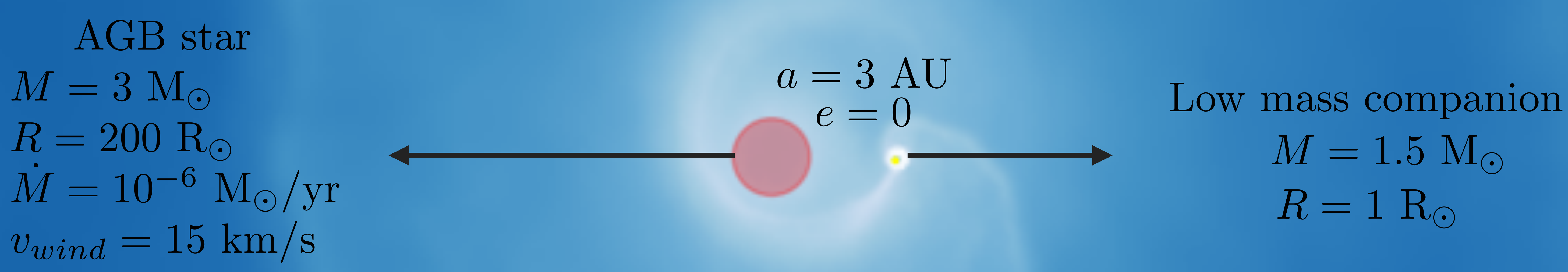


Green: close binaries; mass transfer occurs via Roche lobe overflow. Orange: wide binaries; mass transfer occurs via wind accretion. Arrows indicate the expected direction of orbital evolution, predicting a gap in the range 1-10 yr [1].

AIM

We investigate wind mass transfer in low mass binaries to see how the mass accreted by the companion depends on the system and how it affects the parameters of the initial orbital the evolution of the orbit.

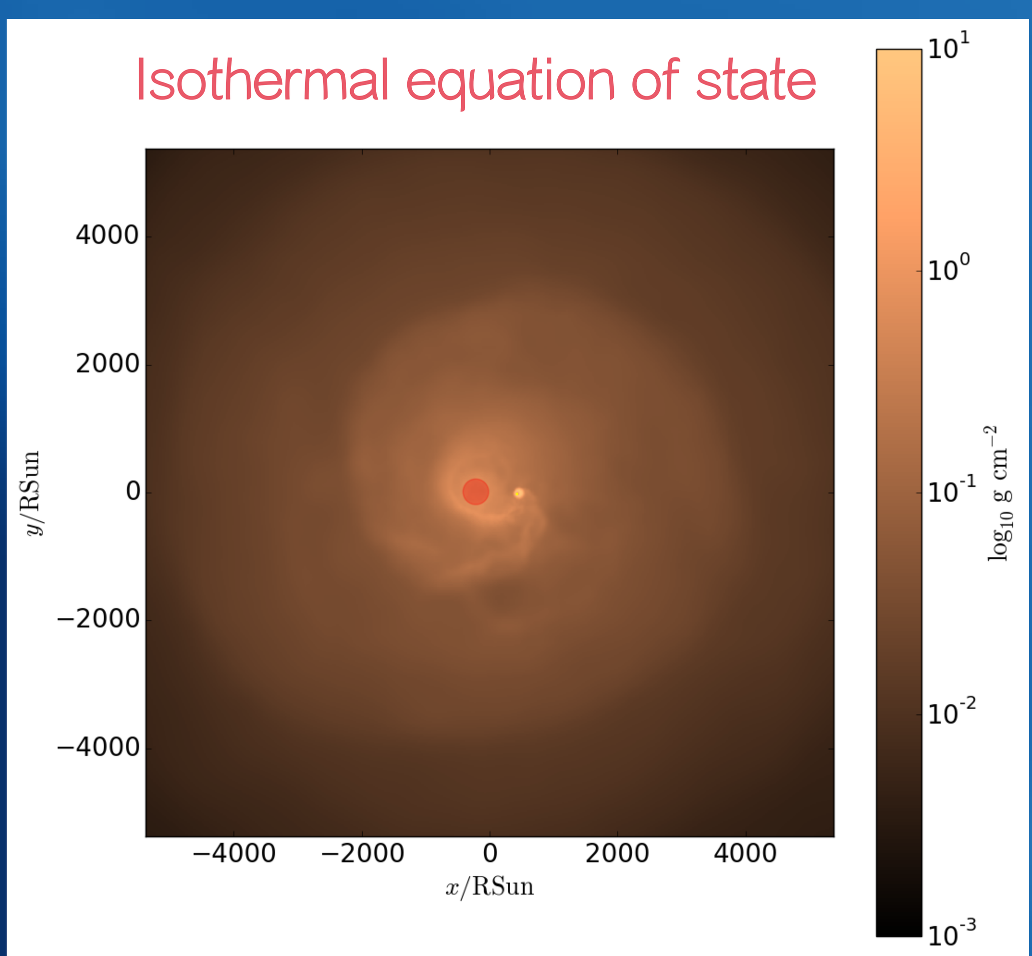




PRELIMINARY RESULTS

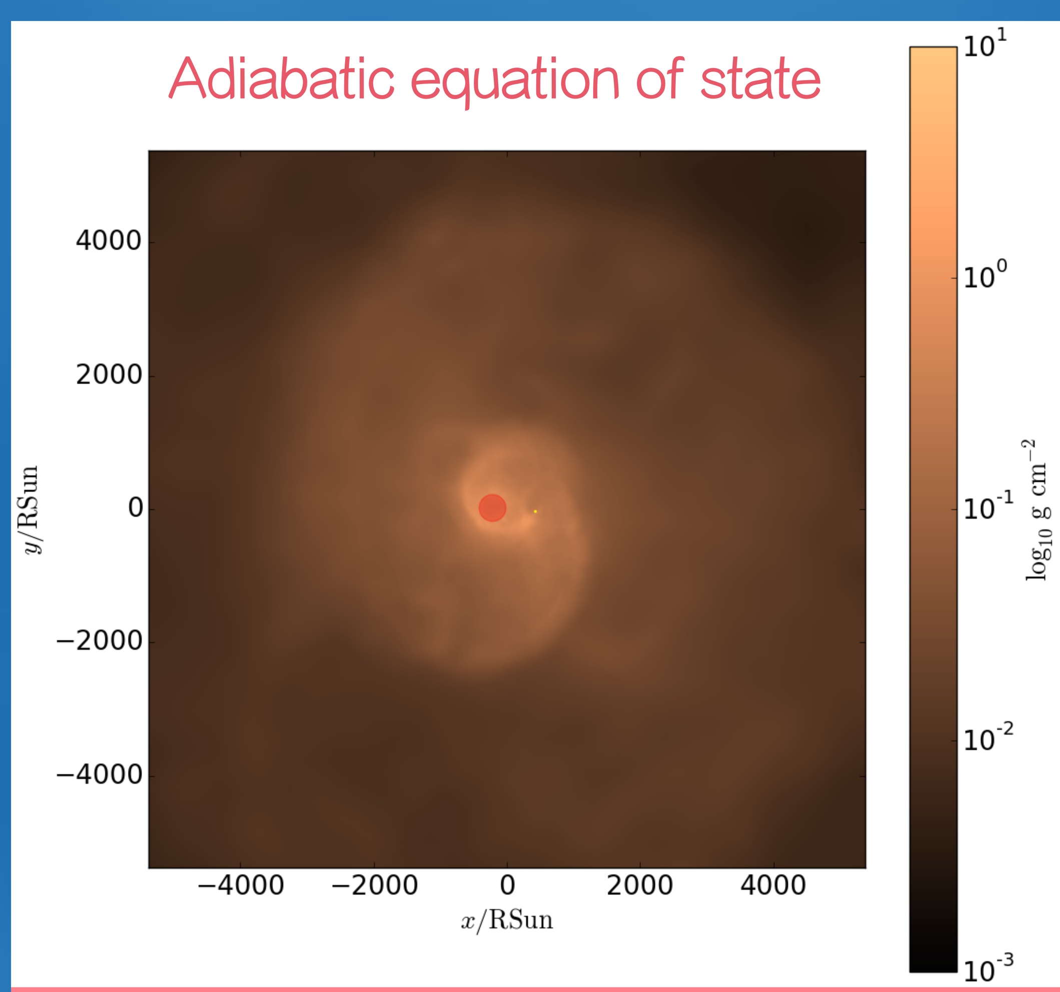
We analyse the flow structure for three cases:

Isothermal equation of state



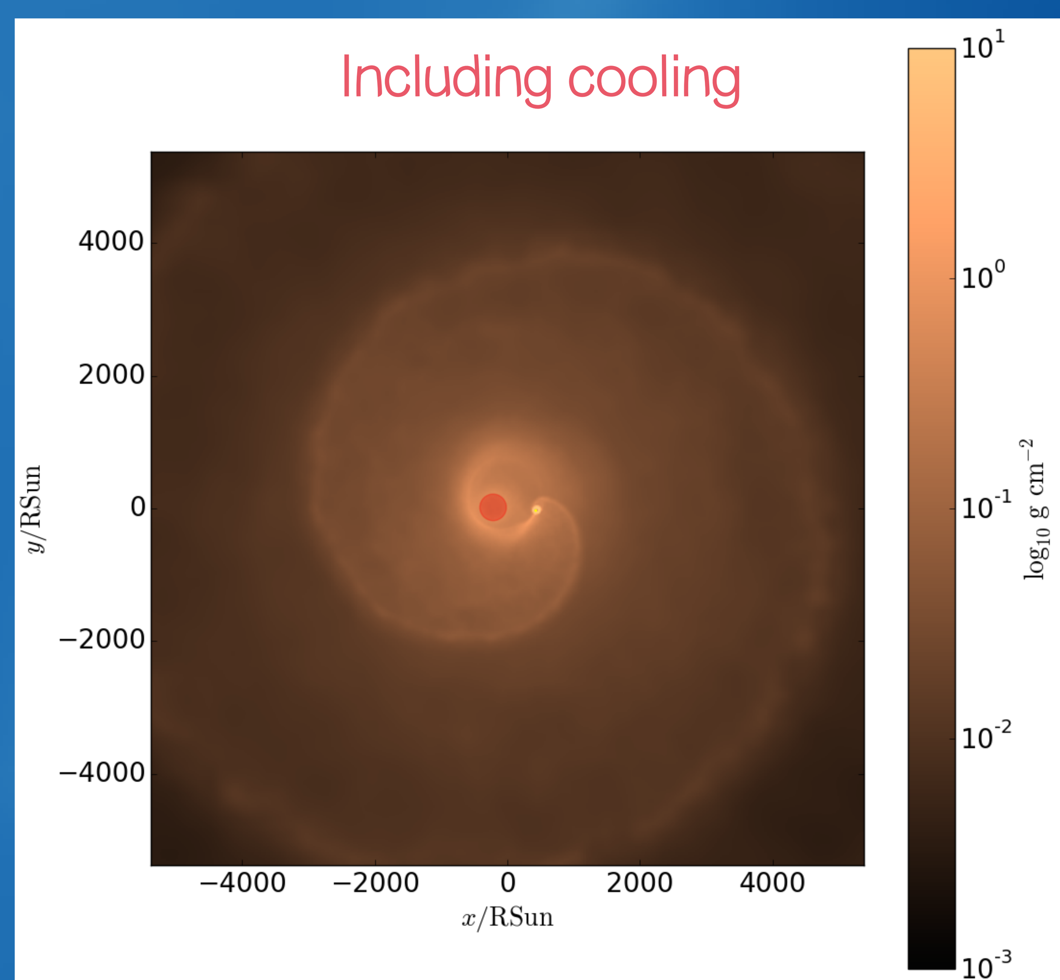
The image shows the line-of-sight column density projected onto the orbital plane. We observe an accretion disk formed around the secondary star due to gas funneling through inner Lagrangian point. The spiral structure is formed due to Coriolis force and gas collision of the accretion wake with gas coming from the primary.

Adiabatic equation of state



The same as the previous image, however in this case no accretion disk is observed: gravity of the secondary compresses the gas coming from the AGB enhancing pressure and preventing it to be confined in a disk.

Including cooling



When cooling due to neutral hydrogen is included [3], the system does not reach very high temperatures, allowing it to be confined in a disk around the companion. The resolution for this simulation is higher than for the previous simulations.

References:

[1] Pols. O. Evolution of Low and Intermediate Stars, Ulaanbaatar (2014)

[2] van der Helm, E. + (in prep)

[3] Bowen, G. H. (1988) ApJ 329:299-317