

Detached shells around old stars

Low-mass evolved stars on the asymptotic giant branch (AGB) lose most of their mass in a strong wind that builds up a gigantic circumstellar envelope (CSE) of dust and molecular gas. As these stars periodically undergo runaway processes called thermal pulses, their chemical content and their physical environment can change drastically. Understanding these thermal pulses is essential to constrain models of stellar evolution and by extent also those of galactic chemical evolution.

Observations reveal detached shells around a number of AGB stars; they are clearly delineated thin shells of high-density gas and dust moving through the outflow. The characterisation of these shells, both chemically and physically, is still limited. Recent observations using the Atacama Large Millimeter/sub-millimeter Array (ALMA) are unrivalled in the level of spatial detail and sensitivity reached. With these in hand, we can now investigate these shells chemically, kinematically, and hydrodynamically, with the aim to understand the changes a star and its outflow undergo during and after a thermal pulse.

The master's student will work on ALMA data of five carbon-rich AGB stars that show detached shells in their outflows. The data are already available and the student will be able to explore the data from initial reduction, creation of a catalogue of observed species, and analysis of the measured information. In the process the student will learn to use the relevant software and analysis routines, as well as develop new analysis procedures. While the project gives a solid basis for a master's thesis, it is at the same time very flexible and allows for the student to develop in an independent direction.

Prerequisites: General physics.
 Some astronomy (e.g., a course on Stellar physics) is useful but not a requirement.

Supervisor: Elvire De Beck, elvire.debeck@chalmers.se, 031-772 55 45