A new generation of dynamical models for Long-Period Variables: A new era for the interpretation of ISO-SWS data of cool giants

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The cool and extended atmospheres of Mira and Semiregular variables are dominated by stellar pulsation, shock waves, formation of dust and molecules and by heavy mass loss. Due to the dynamical nature of most of these phenomena, classical hydrostatic models fail to reproduce the spectra of such stars. This becomes especially evident with ISO-SWS data which cover a large wavelength range and sample also the outer atmospheres of cool variables. Several authors have tried to model the spectra by adding one or more cool, homogeneous and static layers on top of a hydrostatic model or a blackbody. However, this can only be a first (and maybe misleading) step towards understanding the physical processes involved in the formation of the spectra.

We present synthetic ISO-SWS spectra of oxygen-rich cool giants for the wavelength range between 2.36 and 7.75 μm. These are based on a completely new generation of dynamic models (Höfner, this conference) which have been calculated with a non-grey radiative transfer including molecular opacities. We discuss the impact of the time-dependent model structure on the features of CO, SiO, OH and water and compare the results to multi-epoch ISO-SWS observations of oxygen-rich Mira and Semiregular variables. It turns out that many features in the ISO spectra which could not be reproduced within the framework of classical model atmospheres – like emission features or the strong water band at 2.4 μm observed at some phases of Mira stars – can be easily understood without any additional assumptions.

Variability of molecular features on time scales different from the pulsation cycle will also be discussed.