Dynamical atmospheres and winds of AGB stars

S. Höfner (Uppsala Astronomical Observatory, Box 515, SE–75120 Uppsala, Sweden)
R. Gautschy–Loidl (Rüti, Switzerland)
B. Aringer, A. Andersen, U.G. Jørgensen (NBIfAFG, Copenhagen, Denmark)

Atmospheres of pulsating Asymptotic Giant Branch stars present a major challenge for realistic, self-consistent modelling: Propagating shock waves caused by stellar pulsation modify the structure of the atmosphere on local and global scales, causing strong deviations from hydrostatic stratification. The radiative field is dominated by molecular opacities or even by dust grains forming in the cool outer layers of the atmospheres. Important microphysical processes like chemistry and dust formation may be severely out of equilibrium.

Our latest generation of model atmospheres for AGB stars combines time-dependent dynamics and frequency-dependent radiative transfer. This allows us to take both the effects of pulsation and the complex influence of molecular opacities into account. In the case of C-rich stars, the models also include a self-consistent time-dependent description of dust formation. We compare our new models to existing grey dynamical models as well as to classical hydrostatic model atmospheres. We stress the importance of non–grey radiative transfer for obtaining realistic background structures even in highly dynamical models, discussing both the resulting observable properties and the wind characteristics. We study the influence of the microphysical properties of dust grains on the mass loss rate, the wind velocity and the degree of condensation. Presenting synthetic spectra, we argue that the current dynamical models represent an important step in a process leading from a qualitative to a quantitative description of atmospheres and winds of pulsating AGB stars.