NLTE Modeling of Fe II and [Fe II] lines in the shocked atmospheres of M Miras

He. Richter, P.R. Wood [1], P. Woitke, U. Bolick and E. Sedlmayr

Zentrum fuer Astronomie und Astrophysik, TU Berlin, D-10623 Berlin, Germany
[1] *Research School of Astronomy and Astrophysics, Australian National University, Weston ACT 2611, Australia*

Our observations of cool, shock penetrated, expanding atmospheres of M-type Mira stars (see Richter & Wood 2001, A&A 369, 1027) showed that in particular the emission lines of Fe II and [Fe II] are good diagnostic tools to study the physical conditions in the shocked region close to the photosphere of these stars. The erratic appearance of these particular emission lines in stars which had just had a bright light maximum suggests that they require an exceptionally bright maximum for excitation. Presumably, these are associated with stronger shock waves. According to the phase of their appearance it can be estimated, that the Fe II as well as the [Fe II] emission lines must originate close to the star at $\sim 1 - 3R_*$.

To model the Fe II and [Fe II] emission lines and to analyze the hydodynamical conditions which lead to their formation, detailed NLTE radiative transfer calculations in spherical symmetry, applying a co-moving frame formalism and using accelerated lambda iteration have been carried out on a series of specific hydrodynamical shock structures. Our basic parameter studies reveal that the lines from ionized iron originate right from the shock front and that they are in fact emitted close to the stars photosphere.

Work in progress will provide detailed line profiles to fit the observed line shapes in order to extract the full information given by the emission lines of ionized iron in M Miras. Dust formation takes place approximately in the same regions were the Fe II and [Fe II] emission lines originate. Hence a detailed study of these lines will offer the unique possibility to determine the physical conditions in the dust formation zone and thereby will shed some light on the basic mechanism of dust formation in M-type Mira stars.