Abstract

Ground-based interferometry has finally reached a stage in which accurate determination of Cepheid diameters using the Baade-Wesselink method is feasible. Determining these diameters is the base for calibrating the period-luminosity relation relation for Classical Cepheids, and thus the Extragalactic Distance Scale. The accuracy of this technique, however, depends on the availability of reliable limb darkened models for the pulsating Cepheids atmospheres. We present here a new method to compute time and wavelength dependent center-to-limb brightness distributions for Classical Cepheids. Our model atmospheres are based on second-order accurate 1-D hydrodynamic calculations, performed in spherical geometry. The brightness intensity distributions, and the resulting limb darkening, are computed through the dynamic atmospheres by using a full set of atomic and molecular opacities. Our results confirm important differences with respect to equivalent hydrostatic models. The amount of limb darkening, and the shape of the limb profile, show a strong dependence on the pulsational phase of the Cepheid, which cannot be reproduced by static models. Non-linear effects in our hydrodynamic equations add a new level of complexity in the wavelength dependence of our limb profiles, which are affected by the presence of shock waves traveling through the atmosphere. These effects are already detectable by present-day interferometers, and should be taken into consideration when deriving limb darkened diameters for nearby Cepheids with the accuracy required to measure their radial pulsations.

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