Effects of dust on light-curves of εAur type stars

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\epsilon Auriga is one of the most mysterious objects on the sky. Prior modeling of its light-curve assumed a dark, inclined, non-transparent or semi-transparent, dusty disk with a central hole. The hole was necessary to explain the light-curve with a sharp mid-eclipse brightening.
The aim of the present paper is to study the effects of dust on the light-curves of eclipsing binary stars and to develop an alternative physical model for ϵ Aur type objects which is based on the optical properties of dust grains.
The code Shellspec has been modified to calculate the light-curves and spectra of such objects. The code solves the radiative transfer along the line of sight in interacting binaries. Dust and angle dependent Mie scattering were introduced into the code for this purpose.
Our model of ϵ Aur consists of two geometrically thick flared disks: an internal optically thick disk and an external optically thin disk which absorbs and scatters radiation. Disks are in the orbital plane and are almost edge-on. We argue that there is no need for an inclined disk with a hole to explain the current eclipse of ϵ Aur not even if there is a possible shallow mid-eclipse brightening. It was demonstrated that phase dependent light scattering and the optical properties of the dust can have an important effect on the light-curves of such stars and can even produce a mid-eclipse brightening. This is a natural consequence of the strong forward scattering. It was also demonstrated that shallow mid-eclipse brightening might result from eclipses by nearly edge-on flared (dusty or gaseous) disks.

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