Classical Be Stars: Rapidly Rotating B Stars with Viscous Keplerian Decretion Disks

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In the past decade, a consensus has emerged regarding the nature of classical Be stars: They are very rapidly rotating main sequence B stars, which, through a still unknown, but increasingly constrained process, form an outwardly diffusing gaseous, dust-free Keplerian disk. In this work, first the definition of Be stars is contrasted to similar classes, and common observables obtained for Be stars are introduced and the respective formation mechanisms explained. We then review the current state of knowledge concerning the central stars as non-radially pulsating objects and non-magnetic stars, as far as it concerns large scale, i.e., mostly dipolar, global fields. Localized, weak magnetic fields remain possible, but are as of yet unproven. The Be phenomenon, linked with one or more mass ejection processes, acts on top of a rotation rate of about 75% of critical or above. The properties of the process can be well constrained, leaving only few options, most importantly, but not exclusively, non-radial pulsation and small scale magnetic fields. Of these, it is well possible that all are realized: In different stars, different processes may be acting. Once the material has been lifted into Keplerian orbit, memory of the details of the ejection process is lost, and the material is governed by viscosity. The disks are fairly well understood in the theoretical framework of the viscous decretion disk model. This is not only true for the disk structure, but as well for its variability, both cyclic and secular. Be binaries are reviewed under the aspect of the various types of interactions a companion can have with the circumstellar disk. Finally, extragalactic Be stars, at lower metallicities, seem more common and more rapidly rotating.

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