Internal rapid rotation and its implications for stellar structure and pulsations

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Abstract

Massive and intermediate mass stars play a crucial role in astrophysics. Indeed, massive stars are the main producers of heavy elements, explode in supernovae at the end of their short lifetimes, and may be the progenitors of gamma ray bursts. Intermediate mass stars, although not destined to explode in supernovae, display similar phenomena, are much more numerous, and have some of the richest pulsation spectra. A key to understanding these stars is understanding the effects of rapid rotation on their structure and evolution. These effects include centrifugal deformation and gravity darkening which can be observed immediately, and long terms effects such as rotational mixing due to shear turbulence, which prolong stellar lifetime, modify chemical yields, and impact the stellar remnant at the end of their lifetime. In order to understand these effects, a number of models have been and are being developed over the past few years. These models lead to increasingly sophisticated predictions which need to be tested through observations. A particularly promising source of constraints is seismic observations as these may potentially lead to detailed information on their internal structure. However, before extracting such information, a number of theoretical and observational hurdles need to be overcome, not least of which is mode identification. In the present talk, I will describe recent progress in modelling these stars and show how an improved understanding of their pulsations, namely frequency patterns, mode visibilities, line profile variations, and mode excitation, may help with deciphering seismic observations.

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