Asteroseismology of the Nearby SN-II Progenitor Rigel
Part II. $epsilon-$Mechanism Triggering Gravity-Mode Pulsations?

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The cores of luminous B and A-type (BA) supergiant stars are the seeds of later core collapse supernovae.
Thus, constraining the near-core conditions in this class of stars can place tighter constraints on the size, mass and chemical composition of supernova remnants.
Asteroseismology of these massive stars is one possible approach into such investigations.
Recently, Moravveji et al. (2012, hereafter Paper I) extracted 19 significant frequencies from a 6-year radial velocity monitoring or Rigel ($beta$ Ori, B8 Ia).
The periods they determined broadly range from 1.22 to 74.74 days.
Based on our differentially rotating stellar structure and evolution model, Rigel, at itâ€™s current evolutionary state, is undergoing core He burning and shell H burning.
Linear fully non-adiabatic non-radial stability analyses result in the excitation of a dense spectrum of non-radial gravity-dominated mixed modes.
The fundamental radial mode ($ell=0$) and its overtones are all stable.
When the hydrogen burning shell is located even partially in the radiative zone, a favorable condition for destabilization of
g-modes through the so-called $epsilon-$mechanism becomes viable.
Only those g-modes that have high relative amplitudes in the hydrogen burning (radiative) zone can survive the strong radiative damping.
From the entire observed range of variability periods of Rigel (found in Paper I), and based on our model, only those modes with periods ranging between 21 to 127 days can be theoretically explained by the $epsilon-$mechanism.
The origin of the short-period variations (found in Paper I) still remain unexplained.
Because Rigel is similar to other massive BA supergiants, we believe that the $epsilon-$mechanism may be able to explain the long-period variations in $alpha$ Cygni class of pulsating stars.

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