A POSSIBLE PULSATION MECHANISM FOR B STARS

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Abstract. Numerous possible mechanisms for the cause of B star radial and nonradial pulsations have been investigated in the last 30 years, but none have been clearly shown that they actually work. I briefly review these ideas, and then focus on a new idea about the driving due to time-dependent convection. I suggest that the outward going photons are absorbed by CNONe ions so that they capture the photon momentum. Previous investigations by many have shown that the acceleration of these ions can be two orders of magnitude larger than the local gravity. Levitation and concentration of these elements can occur between temperatures of 100,000K and 600,000K, the former temperature set by the complete ionization of the competing photon capturing helium, and the latter by the existence of simpler and less absorbing excited electron structures of the CNONe elements. Then I suggest that the concentration of these elements gives such a large local photon opacity that a thin convection zone exists down to maybe 10^{-5} of the mass of a typical B star. However, there would be no overlap with the outer surface convection zone that exists down to 50,000K in the outer 10^{-9} of the mass. The long time scale of the convection, or even its periodic turning on and off, gives a source of time-lagged luminosity which can be shown in some cases to drive mechanical pulsations in one or more modes. This envelope pulsation mechanism could apply equally to radial and low degree nonradial B star pulsations. It could also explain why not all B stars pulsate unless this unconventional composition structure occurs, disappears, and maybe reoccurs at some evolution stage.

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