The Impact of Large-Scale Surveys on Pulsating Star Research
ASP Conference Series, Vol. 203, 2000
L. Szabados & D. W. Kurtz, eds.

Z-bump Pulsations in Helium Stars

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Abstract. Radial and nonradial pulsations are excited in low-mass helium stars with effective temperatures between 7000 and 35000 K. In the case of the most luminous stars, these are driven by strange-mode instabilities (Saio & Jeffery 1988). Less luminous helium stars are mostly non-variable, except around 25000 K. V652 Her is the prototype radially pulsating helium star, with $T_{\rm eff} \sim 25000$ K and a pulsation period of $0^{\rm d}.108$ (Hill et al. 1981). The pulsation was only understood to be driven by the κ-mechanism with the introduction of Z-bump opacity (Saio 1993).

The importance of Z-bump instability in low-mass helium stars has been investigated further through a series of pulsation models (Jeffery & Saio 1999a). It is shown that Z-bump pulsations can persist to surprisingly high hydrogen abundances in low-mass stars, and may consequently be excited in several helium-rich hot subdwarfs with $T_{\rm eff} \sim 25000$ K. Within the Z-bump instability region, both radial and nonradial pulsations are excited, and multi-periodic variability is expected.

Pulsation properties are closely linked to the global dimensions of a pulsating star by the period – mean density relation. When spectroscopic measurements are also available, the twin constraints of period and surface gravity can place very tight limits on the stellar radius (Jeffery & Saio 1999b). These are in excellent agreement with independent measurements for V652 Her and place a lower limit on the mass of the recently discovered Z-bump pulsator BX Cir (Kilkenny et al. 1999).

References

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