THE EFFECTS OF METAL ENHANCEMENT ON THE PERIOD RATIO OF DOUBLE MODE CEPHEIDS

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Abstract. We increase the metal abundance in the envelope of Double Mode Cepheids (DMCs) in order to remove the period ratio mass discrepancy. By increasing the value of Z, we are able to increase the opacity by a factor of 2 to 2.5. We find that for a star of 5 solar masses, with a temperature of 5957 K, and a luminosity of 1050 times that of the sun, an increase in the metal abundance starting at the Log (T) value of 4.79 and reaching a maximum Z value of 0.3 in the Log (T) range of 4.8 to 5.3 produces a period ratio P_1/P_0 = 0.7089, and a value of P_0 = 3.001 days. The value of Z returns to 0.02 at Log (T) = 5.62. The enhanced zone (part of which convects) is located well below the H and He convective regions. The enhanced region is also stable against downward mixing since the radiative gradient is so sub-adiabatic.

Further calculations are being pursued to investigate the formation of a layer of enhanced metals by radiative acceleration, which will levitate higher Z material upward to regions of lower density and thereby increase the heavy element abundance. We find that the radiative acceleration is greatest in a region of Log (T) = 5.8 to 6.0, about 15% of the mass into the star. This could lead to an increase in the Z abundance at lower temperatures where the acceleration is not as great, and where CNONe could be accumulated.

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