

ASTR367 - HW6

October 13, 2023, Due October 20, 2023

2 pts each question

- 1) Assuming (incorrectly) that the oscillations of  $\delta$  Cephei are sinusoidal, calculate the greatest excursion of its surface from its equilibrium position.
- 2) Assume you found a new Cepheid variable in M51, the Whirlpool galaxy. Further, assume its apparent visual magnitude at the time of discovery is  $m_v = 23$  and its period is 200 days. What distance do you compute for M51? Your answer is likely slightly off from the accepted distance to M51 of  $7.1 \times 10^6$  pc. Why may that be the case?
- 3) Use the equation we derived in class for the pulsation period to estimate the pulsation period of the Sun if it oscillated radially. Make (and justify) reasonable assumptions for  $\gamma$  and  $\bar{\rho}$ .
- 4) Estimate the ideal gas pressure and the radiation pressure at the center of Sirius B (which is a white dwarf), using  $3 \times 10^7$  K for the central temperature. Compare these values with the crudely estimated central pressure,  $P_c \approx 2/3\pi G\rho^2 R^2 \approx 3.8 \times 10^{22}$  N m<sup>2</sup>.
- 5) How many white dwarfs are in the Milky Way? You can estimate this various ways, but it may be useful to know the number of stars in the Milky Way and the average lifetime of stars. You can assume that white dwarf lifetimes are infinite.