

Stellar Astrophysics (PhD Qualifying Exam, 2014)

- (1) A star consists of gases of adiabatic index γ and is in force equilibrium. Please **derive** the virial condition for the star. (20%)
- (2) The radiation transfer equation describes how the photon intensity changes when photons travel across a medium. What is the definition of photon intensity and what variables does the photon intensity depend on? (10%) What is the form of the radiation transfer equation? (5%) Explain what each term in the equation means. (5%) For an optically thick star of surface temperature T , how do you estimate the star luminosity? (10%)
- (3) Under what condition can a star become convective? (5%) Under what condition can a star become pulsating? (5%) What does the Schonberg–Chandrasekhar mass limit tell you about the stellar evolution? (15%)
- (4) A star configuration is described by a set of equations, including the balance of momentum flux, the balance of energy flux and the rate of nuclear energy generation. Please list these equations (15%), and explain why the rate of nuclear energy generation depends very sensitively on the temperature (10%).