

PhD qualifying Exam: Stellar Astrophysics (2/2016)

- (1) In a star, thermal diffusion is the most important process governing the photon transport. Please derive the thermal diffusion flux starting from the radiative transport equation. (15%) What are the assumptions involved in the derivation? (5%) What is the Rosseland mean absorption coefficient? (5%)
- (2) Please explain why the luminosity drastically decreases while the temperature only mildly changes as a low-mass proto-star evolves into the main-sequence star (Hayashi track). (15%) Explain why in the red-giant phase, a low-mass star evolves in a reverse manner as a proto-star. (10%)
- (3) What are the governing equations (several equations involving mass, momentum and energy conservations) for the equilibrium stellar structure of a main-sequence star for which the radiative transport dominates? (25%)
- (4) In the main-sequence phase, there is an isothermal core surrounded by a burning shell. Why does the core become isothermal? (10%) The mass of the core has an upper limit, which is called the Schonberg-Chandrasekhar limit? What is it? (5%) Please derive this limit. (10%)