ENERGY CONSERVATION

From previous sections, we have,

$$\frac{dM(r)}{dr} = 4\pi r^2 \rho(r) \rightarrow \text{Equation of mass conservation}$$

Now,

$$dL = \epsilon\, dm = \underbrace{\epsilon}_{\substack{\text{power produced per} \\ \text{unit mass of} \\ \text{stellar material}}} \rho\, 4\pi r^2\, dr$$

$$\boxed{\frac{dL(r)}{dr} = 4\pi r^2 \rho(r)\, \epsilon(r)} \rightarrow \text{EQUATION OF ENERGY CONSERVATION}$$

THE EQUATION OF STELLAR STRUCTURE

$$\boxed{\frac{dP(r)}{dr} = -\frac{GM(r)\rho(r)}{r^2}}$$

$$\boxed{\frac{dM(r)}{dr} = 4\pi r^2 \rho(r)} \rightarrow \text{Eq. of mass}$$

$$\boxed{\frac{dT(r)}{dr} = -\frac{3L(r)\,\kappa(r)\,\rho(r)}{4\pi r^2\, 4ac\, T(r)^3}} \rightarrow \text{Eq. of Radiative Energy Transport}$$

$$\boxed{\frac{dL(r)}{dr} = 4\pi r^2 \rho(r)\, \epsilon(r)} \rightarrow \text{Equation of Energy conservation}$$