

# Astrophysics and Nuclear Astrophysics (LPHY2263)

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# Mid-term tests

- #1: spectroscopic binaries
- #2: mass-luminosity relationship
- #3: gravitational lifetime
- #4: Coulomb barrier
- #5: hydrostatic thermostat
- #6: the SNO experiment
- #7: nucleosynthesis in AGB stars

# #1: spectroscopic binaries

(Axel Tries)

- Explain how to extract the masses of the stars in a binary system by the spectroscopic method, using the Doppler effect
  - What is the dependence of the result on the distance of the binary stars from us?
  - Do we need to know the inclination of the orbit?
- If these are also eclipsing binaries, explain how you can obtain:
  - The orbital speed
  - The masses without having to know the distance from us

# #2: mass-luminosity relationship

(none)

- Reproduce the full reasoning that we have seen already, about how to explain the observed mass-luminosity relationship in the Main Sequence
- (Note: even better if you do it "à la Bethe")

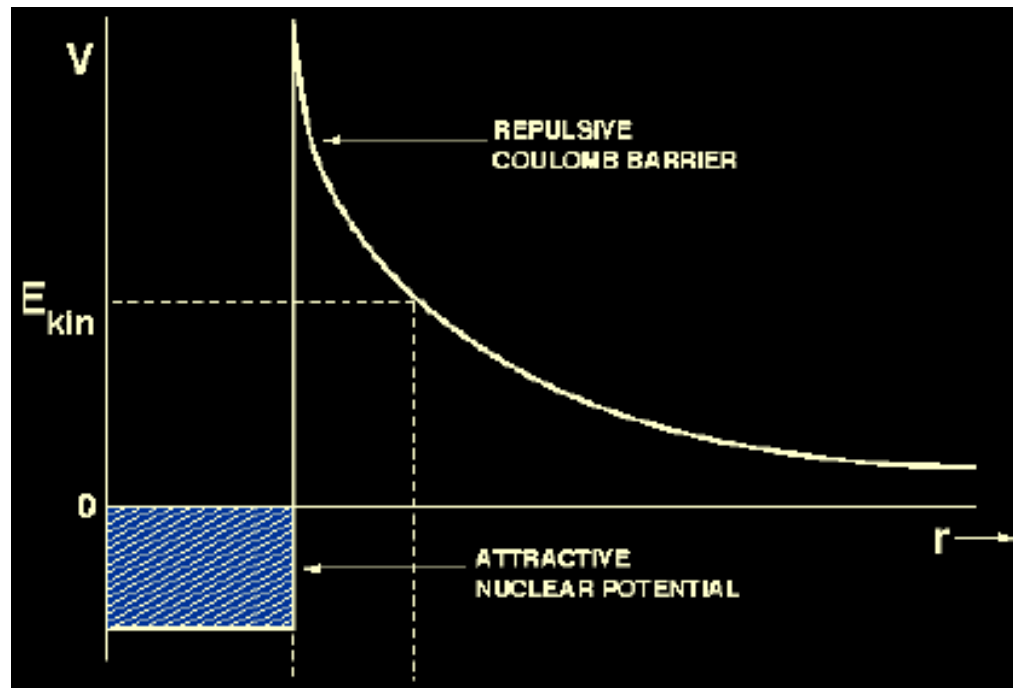
# #3: gravitational lifetime

(Martin Michel)

- If there is no internal source of energy apart from gravitational contraction, how long can a star shine?
- Do the exercise for  $L$ ,  $M$ ,  $R$  of the Sun

# #4: Coulomb barrier (Sylvain Vanneste)

- Calculate the height of the Coulomb barrier for protons, and the transmission probability at  $E_{\text{kin}} \sim 10 \text{ keV}$



$x_1 \sim 10^{-15} \text{ m}$   
 $x_2$ : you can calculate it

# #5: hydrostatic thermostat

(Beatrice Opacka)

- Explain the mechanism of the hydrostatic thermostat
- Explain why it doesn't work in the case of a degenerate electron gas

# #6: the SNO experiment

## (Thibault Libert)

- Explain the design of the SNO experiment
  - Why was "heavy water" used?
  - Why was it sensitive to all kind of neutrinos?
  - How could it discriminate between the electron neutrinos and the other neutrino?
  - Why were there two running modes? (With and without salt)
  - Why was the "heavy water" tank inside a larger "light water" tank?



# #7: nucleosynthesis in AGB stars (Liliya Milenska)

- Illustrate the different kinds of nucleosynthesis during the AGB phase
- In particular, give details on the s-process and on the dredge-up phases

