

# Homework 11

## Problem 1 (5 points)

We derived the free fall time (eq. 12.26). Find how long does it take to contract a cloud to half of its initial size. Assume no rotation, express your answer as a fraction of total free fall time. Hint: you will need to solve a numerical equation.

## Problem 2 (5 points)

Solve problem 12.18 from the textbook. Hints: In (a) collapse stops when velocity is zero, not when the centripetal acceleration equals to gravity pull. Assume that moment of inertia does not change in a, b, and c subproblems, also treat inner mass as spherical object from the gravitational pull point of view.

## Problem 3 (5 points)

Assuming (incorrectly) that solar radiation is all in ultraviolet, find how large would be the radius of the H II emission bubble if the Sun is placed in the middle of a hydrogen cloud with density of hydrogen is  $10^8 \text{ m}^{-3}$  and the recombination coefficient  $\alpha = 3 \times 10^{-19} \text{ m}^3 \text{ s}^{-1}$ . Express your answer in parsecs.