

ASTR 621

Spring 2015

Problem Set #2

Assigned: Thursday, Feb 2nd

To be handed in no later than the start of class on: Wednesday, Feb 11th

We will continue our Problem Set's with some additional end-of-chapter questions from de Pater and Lissauer's text [2nd Edition]:

Problems [complete all parts: a), b), etc.]:

13.5 Compute the molecular viscosity in a protoplanetary disk... (parts a & b)

13.6 Compute the value of α_v necessary for a turbulent disk...

13.7 Diffusion inwards within a viscous circumstellar disk lead... (parts a & b)

[In de Pater and Lissauer 1st Edition Questions 12.5, 12.6, 12.7 are the appropriate questions.]

Show your work. Some of these problems possess an algebra manipulation component, nothing treacherous, but an avenue to explore if you get stuck. For those questions which state, "Show.." I expect a well thought out, thorough explanation from you.

WE WILL TALK ABOUT THE FOLLOWING ITEM THIS WEDNESDAY, FEB 4th.... So, Look it Over but DON'T START ANYTHING !!

I also am working to create an assignment that will involve a wee bit of computing. I will want you to create a contour plot, contouring the Jean's Mass of an object within a domain of Density and Temperature (these two quantities will provide the axes domain). You will select appropriate molecular cloud and cloud core lower and upper Density and Temperature values and within those ranges, at incremental resolution you believe appropriate, you will calculate the corresponding Jean's mass. You will contour (colored, shaded, contour labels only, etc., whatever you prefer) and then within the domain you will highlight that portion of the parameter space that corresponds to 1 Solar Mass, to 1 Jupiter mass, to 50 Jupiter masses, and 10 Solar masses. You'll assume initially that your cloud is composed of H₂ only, and subsequently assume the cloud has solar relative abundances of H₂ and He.

Let me know if you have any questions.

Jim

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Problem Set #2 'Extra' Jeans Mass coding component

Calculating and contouring Jeans Mass values vs Temperature & Density

CALCULATE JEANS MASS VALUES within a domain spanning:

- 5 Kelvin to 500 Kelvin

- Density range sufficient to result in the inclusion of a Jean's Mass being 1×10^{-4} solar masses ($\sim 10\%$ of Jupiter's mass) and a Jean's mass being equal to 10^{11} solar masses (\sim mass of the Milky Way) [you should be able to use your code to determine the appropriate density range that will enable you to access these Jeans Mass values].

You will contour your calculated Jeans Mass values within axes representing Density and Temperature

You will individually highlight in some fashion those portions of your domain that account for:

- a) Mass Values of 5×10^{-4} to 2×10^{-3} Solar masses (\sim Jupiter mass)
- b) Mass values of 0.5 to 2.0 solar masses
- c) Mass values of 8 to 12 solar masses
- d) Mass values of 5×10^{10} to 1×10^{11} solar masses (\sim Milky Way mass)

You will for this assignment assume that the composition of the material is H_2 only, and then you will assume appropriate solar-type ratios of H_2 & He. So, you will create TWO contoured figures, one for just H_2 composition and one for H_2 & He solar abundances.

This will be due Friday, Feb 27th (at the earliest).

You will hand in your contour plots and also a print-out of your code(s).

You can use whatever coding language and/or plotting software you are most efficient with.