

Contraction: to ignition or ignominy (due Mar 20)

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Contraction using MESA

If you haven't done so already, download and install mesa, and run the test case in the `getting started` section, which is a very convenient one for this problem set. And then:

1. Turn off nuclear reactions and let MESA evolve the star for a range of masses (say 0.06 to $6M_{\odot}$, with maybe 7 logarithmically spaced steps). What happens? Why do some continue to contract while others do not? What is the limiting mass? Plot HR diagrammes as well as tracks of central density and temperature. Make a table with relevant properties (e.g., maximum temperature, if any, maximum density).
2. Turn on nuclear fusion, and repeat (stopping when nuclear fusion has started, if it does). Determine the limiting mass for ignition.
3. Change abundances to pure He, C, O, Si, and Fe, and repeat 1 and 2.
4. Discuss your results physically. It may help to check KWW, chapters 28 (on contraction) and 23 (on other main sequences).

Note: On purpose, this problem set is much more open-ended than the previous one. However, you should not have to spend more time. I encourage you to work together.