Astr450 Assignment 9: stellar habitable zones
due Thu Oct 29, 2009

Word limit: none

In class we derived the following relations:

- the stellar mass vs luminosity relation, $L = M^3$,
- the stellar mass vs lifetime relation, $t = M^{-2}$,
- the stellar mass vs circumstellar habitable zone relation, $d = \sqrt{L}$.

For each planet in our solar system (Mercury to Pluto, 9 planets) use these relations to calculate what luminosity of star would be needed to put that planet at the center of the circumstellar habitable zone.

Calculate the mass of the star, and the lifetime.

State in each case whether such a hypothetical solar system would be likely to harbor complex life.

Consider all the factors we spoke of in class: stellar lifetimes, and the location of the tidal lock radius.

Arrange your findings in a table. Follow my example for the minor planet named Ceres.

<table>
<thead>
<tr>
<th>Planet</th>
<th>distance from star (AU)</th>
<th>required stellar luminosity ($L_{\text{sun}}$)</th>
<th>stellar mass ($M_{\text{sun}}$)</th>
<th>stellar lifetime (billion years)</th>
<th>harbor complex life?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceres</td>
<td>2.8</td>
<td>7.84</td>
<td>1.99</td>
<td>2.5</td>
<td>unlikely, stellar lifetime is too short</td>
</tr>
</tbody>
</table>

Requirements for a good assignment

- The assignment is not a group project. All work must be completely original. The assignment will be graded strictly, as expected for a 400-level course. All assignments are weighted equally.
- Have your name, SID, and a word count at the top of the paper. Use numbered question-and-answer format when writing your assignment, NOT a run-on paragraph(s) (50% penalty).
- Be typed, double-spaced, and within the word limit. Assignments longer than the word limit will receive zero credit. Equations and diagrams can be hand written.
- Reference all sources of information you use.
- Use quotations only to illustrate your point, not to make it. If you are unclear about this requirement, then speak with the instructor.
- Show completeness of information, conciseness of expression, have a logical development of ideas, and evidence of thought regarding the content.
- Be professional of presentation, e.g., no ragged ends, creases, or ink blobs on the paper.
- In all ways, show pride in your work.