News from The Society for Astronomical Sciences

Vol. 6, Number 3

2009 SAS Symposium will be a joint meeting of the SAS and the AAVSO—Call for Papers from Both Groups

This year the SAS Symposium will be a joint meeting with the AAVSO spanning 3 days of meetings. The meeting will be held May 19-21 (Tue - Thu), 2009.

It will be held at the Northwoods Resort in Big Bear, CA. The approximate cost of the rooms is $100 when getting the group rate.

Registration will be $30 for members ($40 after May 1) and $50 for non-members ($65 after May 1). For members, you need to be a member of either SAS of AAVSO. Membership in SAS is $25/year. The dinner will be $30-35 on Thursday evening. As in the past we will be having workshops on Tuesday and Wednesday evenings. The cost will be around $50 and the nature of the workshops has yet to be determined.

Talks will be given all three days. There will be a section of 60-90 minutes on one of those days for the AAVSO meeting. There will be evening workshops on Tuesday/Wednesday and the dinner on Thursday.

We're also planning activities Tue/Wed for those who don't want to go to the workshops but want to get together with others at the meeting in a more structured setting.

Abstracts will be due March 13, final papers by May 3.

Presentations

Talks will be 20 minutes (instead of 30). This includes any Q&A and/or setup/take down time. There will be three days of talks. A block of time, length to be determined, will be reserved for the AAVSO membership-meeting. We can make this leading up to lunch/dinner on Tuesday/Wednesday so that those not interested can have a very long meal break.

Proceedings

There will not be a full-set proceedings on paper. There will be an abstract book that includes our usual front pages, including sponsor logos. With each abstract book will be a CD that includes the full proceedings as a PDF and all proceedings back to 2003, maybe 2001 though 2001/2 are informal works compared to 2003 and beyond.

Continued on page 2, SAS 2009

In This Issue

First ever PATS goes off well in Pasadena

The first Pacific Astronomy and Telescope Show (PATS) took place in September in Pasadena. Most members of the SAS organizational committee were present to both check out the.

Cont. PATS page 2

Below: Jerry and Brian making the case for SAS at the PATS. Lee and Bob look on deciding whether to join or not.

Committee:

- Lee Snyder — Co-Chairman
- Robert Stephens — Co-Chairman
- Robert Gill — Audio Visual Webmaster
- Dave Kenyon — Program Co-Chairman
- Dale Mais — Program Co-Chairman, Newsletter editor
- Brian Warner— Program Co-Chairman
- Jerry Foote—Program Co-Chairman

Advisors:

- Arne Henden
- Dirk Terrell
- Alan Harris

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SAS 2009

Submission formats

Microsoft Word 2003 (those using 2007, convert to 2003), OpenOffice (cross-platform freebie that simulates/ works with MS Word), PLAIN ASCII text.

Submission rules

Use the Word template on SAS web site as style guide. Do NOT embed graphics in document. Indicate preferred location in text with "FIGURE 1 HERE", etc. Send graphics as separate files. GIF/PNG preferred for non-photo images (plots, etc.). Photos can be GIF/PNG/JPG. Do not send XLS spreadsheets. Poster presentations will be accepted. Where they will be displayed and if there will be a set-aside "meet and discuss" session will be determined at a later time but there will be some format for posters.

PATS from page 1

event and to meet to organize for the 2009 symposium. SAS was invited to give a talk and Jerry and Brian delivered to over 100 cheering fans. There were seventy vendors present at PATS, many of which do not attend the RTMC event. The SAS may develop a talk and/or workshop for future PATS and perhaps other events where many amateurs gather.

On the right is a picture of the lecture hall during a talk. How many SAS members can you find in this picture?

Membership Information

Membership in your new Society for Astronomical Sciences (SAS).

As was pointed out with the last issue, it was felt that a modest membership fee would greatly help SAS to produce a better product for its members. This fee will be $25.00 per year. What will this membership fee provide? Well for one thing it WILL NOT go to any committee members as part of their efforts within SAS. We volunteer our time for The Society.

Members will receive a discount for the registration fee each year for the Symposium at Big Bear. It will assure you that you will get a copy of the published proceedings each year, even if you do not attend the Symposium. It will help defray costs in bringing in outside speakers (professionals) to the symposium.

Membership is annual and runs from July to June of the following year. To become a member, send $25 to: Society for Astronomical Sciences, 8300 Utica Avenue, Suite 105, Rancho Cucamonga, CA 91730. You may also join online at the registration page of the web site. Membership dues are tax deductible.

We currently have 105 members with many renewals due in by June 1.

The SAS is a 501(c)(3) charitable organization.

Your Participation Wanted!

As I have mentioned in previous Newsletters, we need your participation in the Newsletter. We don't want this to become a one person or just a couple person show. If you have an article which can cover a variety of topics, please put it together for a future Newsletter. Work in progress is always welcome. In addition, we have started a "letters to the Editor" section where we would like to add 2-3 letters from the members/ participants. We had no letters to incorporate into this Newsletter edition. Constructive comments are always welcome as we are always looking for ways to improve not only the quality of the Newsletter but also the quality of the Symposium. We want the SAS to become a year around organization not just a once a year group.

Dispatches from the Members

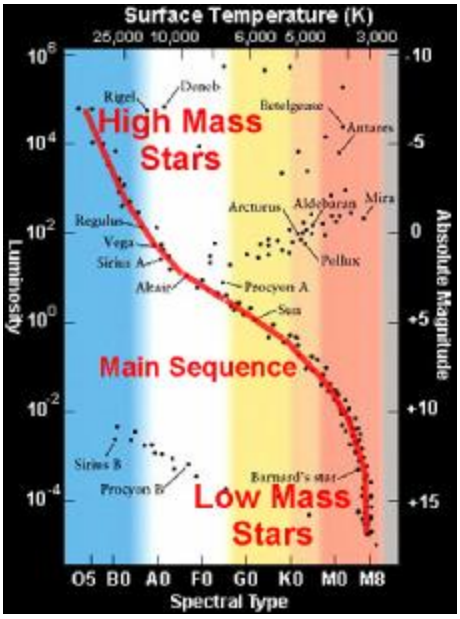
Vol. 6, Number 3

ExoPlanets with Life: Where do we look among the Stars?

Dale Mais

Back in Volume 6 #1 of the SAS Newsletter, we talked about the Hertzsprung Russell diagram and described some of the features it tells us in understanding the stars and their evolution. Lets extend this to the search for extra solar planets. Just what kind of stars do we look at if we want to search for earth like planets. You may want to review that article on the H-R diagram to refresh your memory.

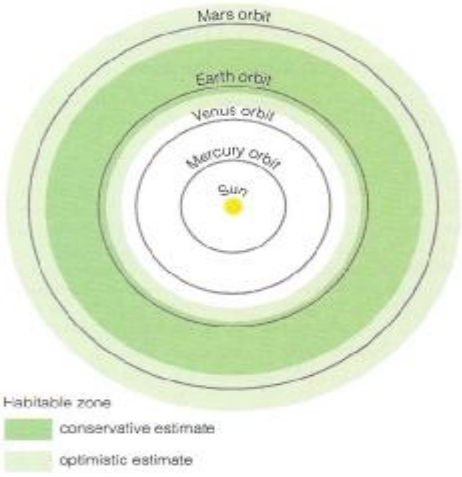
We will restrict our consideration to main sequence stars (MS) because stars spend most of their lives on the MS and things start to get intense as stars evolve off the MS. As a reminder consider the HR diagram below and recall that the MS



is not only a mass sequence, it is also a sequence representing how long a star will spend on the MS. So O and B stars are the most massive but will spend the least amount of time on the MS because they burn through their full so rapidly (on the order of millions to tens of millions of years), while cooler stars K and M types will spend tens to hundreds of billions of years on the MS-they use their fuel frugally.

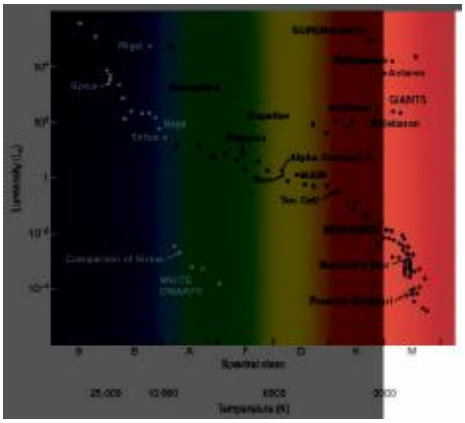
In order to proceed we must introduce the concept of a stellar habitable zone (SHZ) the area around a star where conditions are conducive to life, the temperature is such that liquid water can exist and carbon based molecules are stable. Yes, I already hear the groans about the zeroing in on water and carbon, but there are excellent reasons for this from a chemistry-physics and biological standpoint. These can be taken up at another time in the newsletter. Better yet perhaps one of the readers would like to research this out and write an article for the Newsletter giving us your findings??

Consider the SHZ for the sun, a G2 type star. For both conservative and optimistic



estimates, the earth lies on the inner edge of the suns SHZ. Clearly the atmosphere of a prospective planet plays a role here with greenhouse effects etc. That is why these zones are always a little fuzzy around the boundaries. Mars is on the outer edge of the optimistic estimate and perhaps if it had more mass, with an increased mass of atmosphere and appropriate greenhouse gases, it to would currently harbor liquid water and possibly life. It may some day, since this zone is slowly expanding outward as we will see later on. Lets look at the SHZ for low mass-long lived stars shown on the right.

The HR diagram shows the region we are considering, stellar types K and M. These stars have the great advantage that they live a very long time under stable stellar output of luminosity. This is important for at least with the example of the earth, it takes a long time for life to evolve into more complex forms. Most of earth's history, the first 3 billion years the earth was dominated by bacterial forms of life. More complex life (eukaryotes) and multicellular forms don't appear until around 700 million years ago. So a long lived stable star appears important for complex life. However, notice how the habitable zone shrinks down for a K5 and M type star to become very narrow and very close to the star itself. This very much limits the potential for earth like stars with liquid water for the reason that the



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Dale Mais

planet very easily becomes what is called "tidally locked" with its parent star, where the same face of the planet always faces the star. One side of the star is baking, the other side is freezing. Planets do find a way however. Look at venus which is pretty much tidally locked yet its vast atmosphere and weather patterns distribute heat around the entire planet so the temperature is pretty much even.

The time it takes to tidally lock a planet to its star can be estimated from the equation below, a is the semi-major axis, R is the radius of the planet, m_s and m_p are the masses of the star and planet

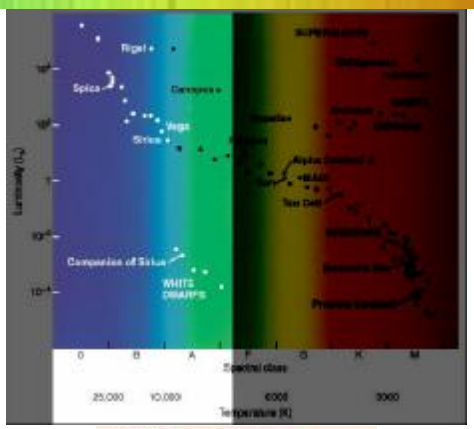
$$t_{\text{lock}} \approx 6\,\frac{a^6 R\mu}{m_s m_p^2} \times 10^{10}\ \text{years},$$

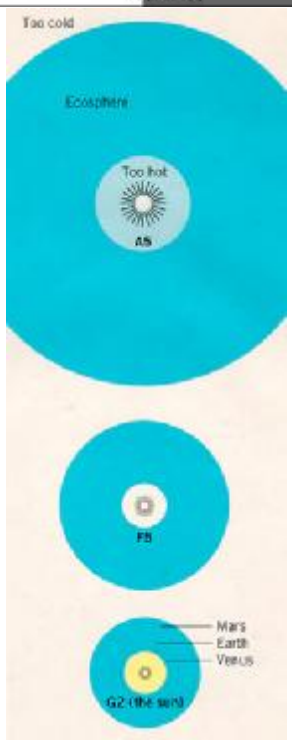
respectively and μ is a variable having to do with the rigidity of the planet. Notice how very sensitive a planet is to tidal locking to its distance from the star, a. The table below shows a calculation, all else being equal, where the semi major axis in AU's is varied and the relative time to tidal lock is shown. For the earth this

Semi-Major axis, a	a^5	Relative time to Tidal Lock
1	1	10000000000
0.9	0.531441	5314410000
0.8	0.262144	2621440000
0.7	0.117649	1176490000
0.6	0.046656	466560000
0.5	0.015625	156250000
0.4	0.004096	40960000
0.3	0.000729	7290000
0.2	0.000064	640000

time is 10 billion years, for Venus at 0.7 AU it is 1.1 billion years and for Mercury at 0.37 AU it is on the order of a few ten's of millions of years. Note that for even a K5 star, the SHZ is <0.4 AU and much smaller for an M type star. Thus planets will have great difficulty avoiding this fate around less massive stars.

For the massive end of the MS we find that the SHZ are greatly enlarged. Consider the SHZ for O, B, A and part of F type stars from the HR diagram. Note how the SHZ expands with the more massive stars up to A5 stellar types. For O and B stars this zone becomes larger than the Solar System itself!. However, in spite of the large SHZ, all is not well. Several things conspire to eliminate the larger mass stars from consideration. First they are very short lived on the MS. The life spans range from just a few million to a few ten's of millions of years, not even enough time for the planet formation process to complete itself. The star evolves off the MS and goes supernova. Not good for a fledgling planet hoping to garner life on its surface. On top of this, these stars pour out massive amounts of ultra violet radiation which again is not good for carbon based molecules. Recall your history of life on earth. Life, and especially more complex life could not get a foothold on earths dry surface until enough oxygen had been produced in the atmosphere to allow the formation of the UV protective ozone layer. At that point, only about 700-800 million years ago, could life venture onto land and become more complex. It took time to build the oxygen content of earth's atmosphere, several billion years in fact.





So what are we left with? We are left with stars of spectral type F5 to K5 which seem to possess all the attributes we think are important for earth like planets to potentially harbor life.

1. A star that lives a long time on the MS, providing a relatively stable luminosity over time.
2. Not too intense of radiation output that is detrimental to organic molecules.
3. Not too narrow and close to star SHZ such that tidal locking is not an issue.

This then is the region of the spectral sequence in which astronomers on the outlook for exo-earths are focusing their searches. But nothing lasts forever, even the sun. Fuel is being consumed and that means the sun or any star is evolving.

Challenge to the readers

Consider and study the diagram on the next page and see what is happening to the SHZ around the sun. Why is this happening? What is the chemistry/physics taking place? Hint: you will need to think on the ideal gas law. Email me your answers, explanation to follow in next Newsletter. *dale.mais@mpiresearch.com*

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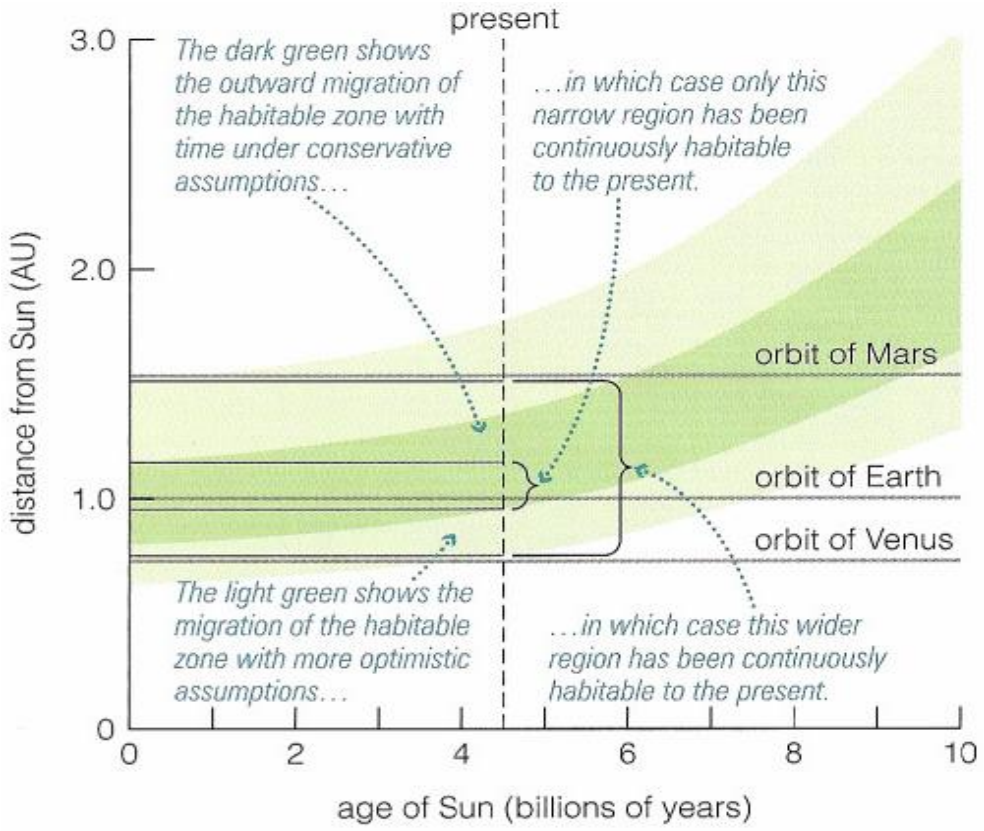

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