

## Honors Seminar 259 — cheat sheet for 10/20/2008 — Andrew Baker

### Lineweaver et al. (2004)

You should read the whole article. Key questions:

1. What are the three key considerations that determine when and whether a planet is “habitable” by complex multicellular life?
2. Why isn’t the Sun exactly at the center of the green zone in Figures 3 and 4? Would we expect it to be?

Key terms:

- **accretion** = process by which gas from some external reservoir flows onto or into a massive structure (e.g., a star, a black hole, or a galaxy)
- **active galactic nucleus** = a supermassive black hole at the center of a galaxy that is converting the potential energy of inflowing matter into lots of radiative and mechanical/kinetic energy
- **corotation** = a dynamical resonance in a rotating disk, close to which stellar orbits are unstable
- **cumulative integral** = the total area enclosed under a curve to the left of some value of  $x$
- **kiloparsec** = a distance of about 3000 light-years (the Sun is about 8 kiloparsecs from the center of the Milky Way)
- **molecular clouds** = large clouds of gas that is sufficiently cold and dense that most of the hydrogen content is in the form of diatomic molecules
- **normal distribution** = bell curve
- **starburst** = an event in which a galaxy (or a part thereof) undergoes an unusually vigorous episode of star formation
- **stellar initial mass function** = a mathematical description of the relative numbers of stars of different masses that are formed when a parcel of gas is converted into stars

### Leitch & Vasisht (1998)

You should read the whole article. Key questions:

1. Why do the authors argue that vertical oscillations are not responsible for periodic extinction events?
2. What are all of the bad things that can happen to the Earth when the solar system is passing through one of the Milky Way’s spiral arms?

3. What is the main, “take-home message” of Figure 3? Are there any aspects of the data that don’t support the authors’ conclusions, and if so, how do they deal with this problem?

Key terms:

- **21 cm line of neutral hydrogen** = a spectral line produced by neutral hydrogen atoms with a wavelength of 21 cm (the best way to find neutral hydrogen in any environment!)
- $\Omega_{\odot}$  = angular speed with which the Sun is moving around the center of the Milky Way
- **boloidal** = adjective referring to a *bolide*, i.e., a very large impactor whose full nature is not known
- **Bondi accretion** = process by which gas flows in a spherically symmetric fashion onto a central object
- **core collapse** = the event in the center of a massive star that triggers the explosion of its outer layers as a supernova
- **cosmic rays** = energetic particles (protons, electrons, and helium nuclei) that are accelerated to very high speeds by shocks in supernova shells, active galactic nuclei, and other energetic astronomical sources
- **$\gamma$ -ray burst** = gamma-ray burst = energetic explosion that produces copious radiation at the highest energies
- **gaussian** = a normal distribution = bell curve
- **Gyr** = gigayear = one billion years
- **H109 $\alpha$  radio recombination line** = a spectral line that results when an electron hops from the 110th to the 109th energy level within a neutral hydrogen atom (this happens most often when the electron has recently been recaptured by a free-floating proton)
- **H II region** = a roughly spherical volume of gas that has been ionized by the energetic photons coming from one or more young stars
- **isolation** = radiation from the Sun onto the Earth
- **K/T** = boundary between the Cretaceous and Tertiary periods, coincident with the extinction of the dinosaurs
- **Myr** = megayear = one million years
- **pattern speed** = angular speed at which the Milky Way’s pattern of arms (not the stars themselves!) moves, or a similar angular speed for a bar, or a similar angular speed in another galaxy

- **pc** = parsec = a distance of about 3 light-years
- **pulsar** = the rapidly rotating, radio beacon producing neutron star remnant that can be left behind after a supernova explosion
- **Sagittarius-Carina arm** = one of the arms in the Milky Way's spiral pattern that is relatively close to us
- **scale height** = characteristic height of a particular set of astronomical objects above or below the plane of a disk
- **Scutum-Crux arm** = one of the arms in the Milky Way's spiral pattern that is relatively close to us
- **solar galactocentric radius** =  $R_0$  = the distance of the Sun from the center of the Milky Way (about 8 kiloparsecs)
- **unwinding** = tendency of spiral arms to be less tightly wrapped (when viewed from above) at earlier times
- **vertical oscillation** = in galactic dynamics, the motion of a star up and down with respect to the plane of the disk at the same time that it is revolving around the center of the disk