'The Living Cosmos: Our Search for Life in the Universe' by Chris Impey

The likelihood of discovering (and perhaps communicating with) extraterrestrial life.
By Sara Lippincott, Los Angeles Times Staff Writer
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I used to feel confident that we had plenty of time to get off this planet before it burned up. You may know, or perhaps have forgotten, that in 5 billion years the sun will have become a red giant whose circumference will encompass the orbit of Mars. But Chris Impey, an astronomer at the University of Arizona, warns that only a billion years from now the swelling sun "will boil away the oceans." The Bush administration will surely be unimpressed, but it behooves the rest of us to plan ahead.

Impey has written a wonderfully readable book about the chances of life existing elsewhere in the universe (pretty high, in spite of the universe's appalling violence). But "The Living Cosmos" is not about just that. It is an overview of everything you need to know about the fundamentals, including how we got here and where we're probably going. More important, the science -- a word that often causes eyes to glaze over -- is laid out with uncommon clarity and panache.

The field of astrobiology (only about 50 years old and ill-named; it used to be called exobiology, which makes a lot more sense) has been criticized as "a subject with no subject matter." But there's plenty to speculate on. Impey begins with 40 pages' worth of basic cosmology, in which he manages to make the big bang almost visualizable, noting that the brief inflationary period immediately following the bang increased the size of the universe "from a proton to a grapefruit." It also homogenized everything, so that everywhere we look, the universe (now, 14 billion years later, a great deal larger than a grapefruit and getting larger and larger, faster and faster) looks pretty much the same.

OK. On to life, with the proper caveat: "[I]n the diverse astronomical habitats where life might exist beyond the Earth, the senses might be wildly different. When we come to ask the question 'Are we alone?' the problem may be that alien life experiences its world so differently that there's no way to communicate with it." He includes, by way of horrible example, a photo of "the hardy tardigrade," or water bear, a gruesome creature fortunately much too small to be seen with the naked eye but which, boasting "more than 750 distinct" species and living anywhere it wants, is "one of the Earth's oldest and most successful life-forms." The point is that chemistry in the cosmos, thanks to work going on in the centers of stars, is ubiquitous -- including the carbon-based compounds that allow for complexity and, given enough time after falling onto a planet, can arrange themselves into something that grows and reproduces and ends up thinking. ("The number of different molecules that can be made using carbon is essentially infinite," Impey writes.) Finding those that have progressed, as we did, past the water-bear stage is another matter.

Time is one problem. (Impey has a lot of interesting things to say about time, which is physically a very dicey construct. Did you know that there's no such thing as time to an atom? "Time's 'arrow,' " Impey writes, "seems to be an emergent property of large collections of atoms.") Information cannot go any faster than the speed of light, which puts constraints on interstellar -- to say nothing of intergalactic -- communication. Moreover, who knows whether an intelligent, technically inclined civilization has arisen at a time corresponding to our own?

Before getting to the galaxy, though, Impey surveys the solar system, which does have niches, on various moons, that might support life, though probably not the communicating kind. Titan, a hydrocarbon-rich moon of Saturn, is perhaps the most promising. We've already taken a hard look at it; Impey describes the terrain as bathed in "a dull orange glow, like asphalt lit by sodium light at night."

Moving on, he invokes the famous (to astronomers and also fans of the estimable Carl Sagan) Drake equation, devised by astronomer Frank Drake in 1961 at a SETI (Search for Extraterrestrial Intelligence) conference. It's a formula for calculating the number of intelligent civilizations we might reasonably expect to communicate with in our galaxy -- just one of 200 billion (observable) galaxies, don't forget. It includes such factors as the number of stars in the Milky Way (200 billion), the number of habitable planets (unknown), the nature of their biology (ditto) and the possible longevity of technological civilizations that might arise on them. With regard to longevity, Impey points out that a civilization might well build beacons "that continue to transmit after its demise."

It's a wide-open formula, and many estimates have been made. The optimists, whom Impey describes as believing that "life, intelligence, and technology are nearly inevitable once you have a habitable planet," estimate there are as many as 100 million "currently communicable" civilizations. Impey is more circumspect, regarding the Drake equation as limited by the guesswork involved; still, he estimates the number of habitable worlds in the Milky Way at 25 million. The inevitability of intelligent life is open to question, though it's unlikely that what happened on this planet is unique. Whatever the case, it's nice to know that we may have somewhere else to go before the seas begin to boil.