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Light zap in space hints at life origin

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Tom Beal Arizona Daily Star Arizona Daily Star | Posted: Tuesday, October 26, 2010 12:00 am | Comments

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Submitted Photo Sarah Hörst

Scientists were tantalized when the Cassini spacecraft discovered molecules in the atmosphere of

Saturn's moon Titan that were too big for its onboard instruments to analyze.

Now an international team led by University of Arizona graduate student Sarah Hörst proposes that some of those molecules may be the precursors of life.

Hörst is excited about that aspect of her discovery.

She is also excited that her team's experiment may be the first to have produced these "prebiotic molecules" without using water.

She is excited, quite frankly, about every aspect of what she does in her research at the UA's Department of Planetary Sciences.

"The most exciting thing of all is that we're just beginning to understand the kinds of chemistry that atmospheres are capable of doing," Hörst said when asked to choose just one thing to be excited about.

Planetary scientists have long thought Titan to be one of the most suitable places in our solar system for life to develop. It has a thick, hazy atmosphere that was suspected to contain a variety of simple molecules.

Cassini, which flew through the upper reaches of its atmosphere, was able to identify many of its constituents. Its onboard mass spectrometer, which measures the masses and relative concentrations of atoms and molecules, wasn't prepared to deal with the unpredicted, larger molecules it encountered.

Hörst, working with collaborators in Paris, prepared samples of Titan's atmospheric components - methane, nitrogen and carbon monoxide - that were zapped with radio waves to mimic the accelerated impact of sunlight on the upper reaches of Titan's atmosphere. Analysis with a sophisticated mass spectrometer in Grenoble, France, signaled the presence of a lot of unidentified molecules in the aerosol produced by the experiment.

Hörst developed a computer program that searched that data specifically for the compounds known to be precursors of proteins that combine to make RNA and DNA - the stuff of life on Earth. She found 18 molecules whose makeup made them good candidates.

With further analysis, she was able to name seven of them: glycine and alanine, the simplest amino acids, and adenine, cytosine, uracil, thymine and guanine, nucleotide bases of RNA and DNA.

She presented a poster outlining her results at this month's Planetary Science Division meeting of the American Astronomical Society. It attracted lots of attention, with articles in Science and National Geographic.

Hers was the latest in a long line of "life in a bottle" experiments that have tried to simulate the process by which energy transforms chemistry into biology. A paper produced by the team is currently being

vetted for publication, and no reviewer has yet challenged the claim that this is the first time prebiotic molecules have been produced without adding water, Hörst said.

So what's it all mean?

Well, conservatively speaking, it means that you can concoct an experiment with some known components of Titan's atmosphere, hit them with a power source that approximates the effect of the sun's rays, and find some of the prebiotic building blocks of life.

Theoretically, it means those prebiotic molecules and others might rain down on the frozen surface of Titan and someday encounter the conditions that we think may have created life.

"Some might criticize the experiment because it found what it was looking for," said Mark Smith, head of the Chemistry Department at the UA and a member of the research team.

But Smith said these chemicals show up because "the forces of chemistry and bonding and thermodynamics tend to favor certain molecules. These building blocks of life are building blocks because they're thermodynamically and kinetically favored," Smith said.

"It's quite cool," Smith said, and it brings scientists closer to knowing what the "feed stock" was when life began on Earth, in addition to allowing them to theorize about future life on Titan.

Smith and Hörst both said the experiment also gives NASA scientists a better idea of where to look and what instruments to bring along should they decide to revisit Saturn and its moons.

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