The chemistry of space grows more complex

Scientists tracking radio signals are surprised to discover 'impossible' molecule-rich jets from distant stars.

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The chemistry of outer space continues to amaze astronomers. After several decades of doubt, they know that chemical processes around and between stars produce complex molecules including precursors of organic life. But recent discoveries with a new observing technique show they have barely glimpsed what's really going on.

The new observations are revealing what University of Arizona astronomer Lucy Ziurys calls "interesting things that weren't supposed to be there."

Astrochemist Ian Hollis at NASA's Goddard Space Flight Center in Maryland says the new discoveries show "there are many more ways to build large organic molecules in cosmic environments than have been explored." That includes many more ways to make organic life's chemical precursors than astronomers have imagined.

Every complex molecule absorbs and emits radio waves at unique frequencies. You can think of it as a molecule's radio signature. Chemists can discover those "signatures" in the laboratory for any molecule they're interested in. Then they can look for those signatures among the stars.

That's how Dr. Ziurys and her colleagues in Tucson, Ariz., found something that should not be happening around the giant star VY Canis Majoris some 5,000 light years away. It's one of the brightest celestial objects when viewed by infrared light. But observations with infrared or visible light have not revealed what radio tracking of molecules now shows. Two molecule-rich jets shoot out from the star. It's the kind of chemistry expected around relatively nearby stars that are rich in carbon and poor in oxygen. VY Canis Majoris, however, has twice as much oxygen as carbon. As explained in the university's announcement of this research last week, this discovery shows that there are far more sources of complex molecules to enrich the interstellar dust from which planets form than astronomers have suspected.

Half a century ago, astronomers thought complex molecules couldn't exist in interstellar space because ultraviolet radiation should blast them apart. Observers have identified over 140 interstellar molecules since then. But doubts about negatively charged molecules have lingered. Such molecules would have extra electrons that UV radiation should easily knock off. Forget that. In less than a year, radio tracking of molecular "signatures" has found three such "impossible" molecules.

The National Radio Astronomy Observatory in Socorro, N.M., announced another discovery last week by two teams of observers. The observatory's team found negatively charged molecules of a chemical called octatetraynyl around a giant star about 550 light-years away in the constellation Leo. The other team, based at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass., found it in a cold gas cloud in the constellation Taurus. Both teams used data from the Robert C. Byrd radio telescope in Green Bank, W. Va.

Only a chemist could love that molecule's name. But the implications of finding it in more than one place are literally cosmic. Taken together with the discovery of two other negatively charged molecules since last December, it implies that a type of molecule that should not exist in outer space probably is abundant in our galaxy. And, since the electrical properties of molecules play a major role in chemical activity, it also shows astronomers that they have scarcely begun to learn the chemistry that takes place among the stars.