

## **Diamondoids in Space**

Diamonds may be rare on Earth, but surprisingly common in space -- and new research shows that the infrared eyes of NASA's Spitzer Space Telescope are perfect for finding them. Hi I'm Daniel Brennan.

*This Spitzer Space Telescope podcast is part of a series highlighting recent discoveries in infrared astronomy. It's produced by NASA's Spitzer Science Center at the California Institute of Technology in Pasadena. The Spitzer mission is managed by NASA's Jet Propulsion Laboratory.*

At 25 times smaller than a grain of sand, cosmic diamonds are way too tiny for an engagement ring. But, that's not why astronomers want to find them. Scientists believe that the real value of these cosmic gems lays in the insights they provide about the life of carbon-rich molecules in space. Carbon is the basis of diamonds, and of course, all life on Earth.

According to Dr. Charles Bauschlicher of the NASA Ames Research Center, diamonds have only been spotted twice in space. However, astronomers began to speculate about their cosmic abundance in the 1980s, when studies of meteorites that crashed into Earth revealed numerous diamonds about a nanometer -- that's a billionth of a meter -- in size.

These studies showed that three percent of all carbon in meteorites comes in the form of "nanodiamonds." And scientists speculated that if meteorites are representative of the dust content in space, then just a gram of dust and gas in a molecular cloud could contain as many as 10,000 trillion nanodiamonds.

But one fundamental question remained: If diamonds are abundant in space, why haven't astronomers seen more of them?

Bauschlicher believes that astronomers just didn't know enough about the infrared and electronic properties of cosmic nanodiamonds to detect a chemical fingerprint.

Using computer software, Bauschlicher and his collaborators solved this dilemma by simulating conditions of an interstellar medium filled with nanodiamonds, and developed a strategy for finding them. Their research revealed that the cosmic gems shine brightly at infrared light ranges of 3.4 to 3.5 microns and 6 to 10 microns, where Spitzer is especially sensitive.

The unique spectral signature occurs when high-energy ultraviolet light causes molecular bonds in the diamonds to bend and move. Since diamonds are made of tightly bound carbon atoms, it takes a lot of high-energy ultraviolet light to produce a spectral signature. So team members concluded that the best place to see the spectral signature of a cosmic diamond is right next to a hot star.

Now that astronomers have a strategy for finding cosmic diamonds, Ames astronomer Dr. Lou Allamandola, says the next mystery is figuring out how they form in space. On Earth, diamonds form under immense pressure, deep inside the planet, where temperatures are also very high. However space diamonds are found in cold molecular clouds where pressures are billions of times lower and temperatures are below minus 240 degrees Celsius, or minus 400 degrees Fahrenheit. As always, the research continues.

For the Spitzer Science Center, I'm Daniel Brennan

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