

Ask an Astronomer

Question: "What's between the stars?"

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You've probably heard that outer space is a vacuum, but what exactly do we mean by that?

To give you an idea, let's pretend that this entire auditorium is one cubic centimeter -- that's about the size of a key on a traditional computer keyboard. And now pretend that this ball is one molecule of gas or dust.

Here on Earth, normal atmospheric pressure would mean there'd be about fifty quintillion balls crammed into this room.

But when we talk about a "vacuum," we don't mean there are no balls in this volume, it's just that there aren't very many. In fact, the best vacuum we can make on earth would have about 1000 balls in this auditorium.

But for most of space, you have only one molecule per cubic centimeter. That means there would only be one ball in this entire room. That's a pretty good vacuum! But remember, space is BIG!

There's a hundred centimeters in one meter, and a thousand meters in one kilometer. And one light-year is about 10 trillion kilometers. And the nearest star to us is about four light-years away. And most stars are even farther away than that. The star Betelgeuse, for example, is about 640 light-years away. So even though there's only one molecule per cubic centimeter, that's a lot of molecules.

We call this stuff between the stars the interstellar medium. It's mainly made up of hydrogen plus a little bit of other gases and some dust thrown in as well. The denser regions of this almost look like clouds to an infrared telescope, so we call them "infrared cirrus."

And even though this stuff is mind-bogglingly thin, if you look through light-years of it, it eventually blocks out all visible light coming through. But infrared light gets through a little bit more easily.

Understanding the interstellar medium is one of the areas where infrared telescopes really shine, so to speak. It's one of the main advantages of using the Spitzer Space Telescope. For "Ask an Astronomer," I'm Dr. Michelle Thaller of the Spitzer Science Center at the California Institute of Technology.