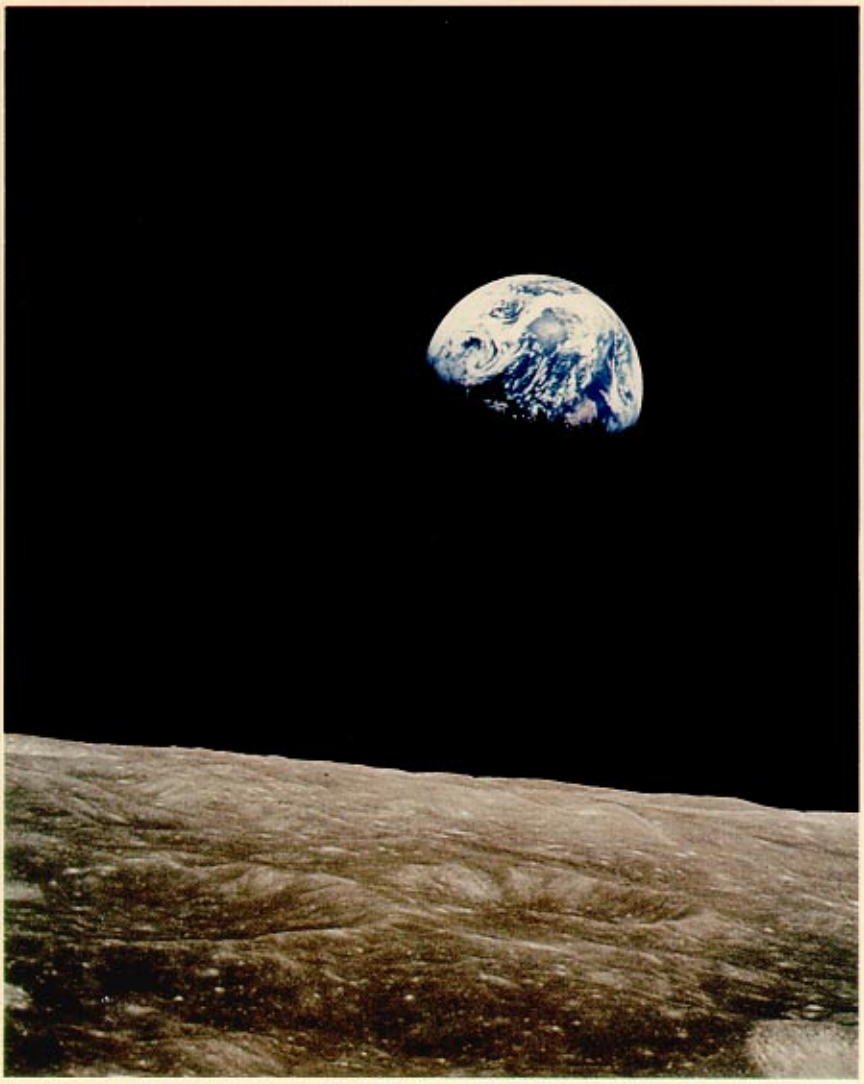
THE UNLIKELY SOURCE

The two lightest and simplest atoms are hydrogen and helium. Together they make up most of the universe. About 90 percent of the atoms in the universe are hydrogen, and 9 percent are helium. All other atoms make up less than 1 percent of the total.

Both hydrogen and helium come in two atomic varieties. Most hydrogen atoms contain a single proton in their nuclei. These are, therefore, referred to as hydrogen 1. One out of every 6,000 hydrogen atoms has a nucleus made up of two particles, a proton and a neutron, and these are atoms of hydrogen 2. (Scientists can prepare hydrogen 3, with one proton and two neutrons in the nucleus, but this combination is radioactive and doesn't last long.)

Almost all helium atoms contain four particles in their nuclei, two protons and two neutrons. These are helium 4. One out of every million helium atoms has a nucleus of only three particles, two protons and a neutron, and these atoms make up helium 3.

If two atoms containing one, two, or three particles in their nuclei are forced together so as to fuse into a larger atom, a great deal of energy can be produced. This is nuclear fusion. For 35 years, scientists have been trying to find ways to make controlled nuclear fusion practical. They have not quite succeeded yet, but they have discovered a great deal about the details.



The Moon's surface soil is the closest, most accessible source for large deposits of helium 3, an atom used in nuclear fusion.

For instance, it seems that the fusion of hydrogen 2 and helium 3 might be the most practical type of fusion reaction we can find. The starting materials and the finishing materials are not radioactive. Free neutrons are produced, and these are troublesome, but fewer neutrons are produced in this fusion reaction than in the other possible ones. Finally, a fusion of hydrogen 2 and helium 3 produces more energy for a given weight of material than do other kinds of fusion reactions.

It sounds good, but there is a catch. The catch does not involve hydrogen 2. Earth's oceans are loaded with hydrogen atoms, and even the comparatively rare hydrogen 2 variety can be isolated in large quantities. However, helium is very rare, and helium 3, which makes up only a millionth of the helium atoms, is exceedingly rare indeed. If all the helium 3 on Earth were collected and fused, it would supply us with less energy than mankind uses in a year.

Is there any place outside Earth we can get helium 3? The nearest available huge supply is on Jupiter, a planet that is mostly hydrogen and helium and a place where even the rare helium 3 builds up to enormous quantities. But we have to get to Jupiter and figure out ways of collecting it from the planet's upper atmosphere and then bringing it back.

The Sun is closer than Jupiter and has 1,000 times as much helium 3, but, of course, there's no chance at all of getting near enough to the Sun to collect any of it.

But we don't have to go to the Sun. It comes to us. The Sun's heat is such that it drives a continuous drizzle of atomic nuclei off its own surface and into space in all directions. This is called the solar wind. The Sun