always came from the same point in the sky, thus ruling out an artificial source such as a satellite. Another member of the team calculated the distance to the source—it was a thousand light years away.

Logically, if the signals were indeed artificial, they must be coming from intelligent aliens. Little green men.

Bell dubbed the source LGM-1 (the first “little green men” signal) and continued her observations while she, Hewish and the others debated how to announce their discovery. They didn’t really believe the signals were coming from aliens, but they were at a loss for any natural explanation.

And then Bell found another source, and soon another, and another, all in different parts of the sky and all showing the same regularity (but with slightly different periods). It seemed very unlikely that four groups of aliens were all broadcasting at the same frequency. Bell and Hewish quickly dropped the LGM hypothesis.

**RADICAL NEUTRONS**

Publication of their findings in 1968 generated a flurry of excitement among astronomers and physicists trying to comprehend the peculiar phenomena, which Hewish (or the press—the record’s not clear) had dubbed pulsars (“pulsating stars”).

Within a few months, the late American-based astronomer Thomas Gold (he died in June 2004) came up with the answer. Bell’s “scruff” turned out to be the telltale “voice” of one of the most bizarre objects in the universe, born times more powerful than can be created at the Earth’s magnetic Field Laboratory. This vast magnetic field, Gold said, channels charged particles to the star’s magnetic poles, where they create an intense, directed stream of radio waves. Since (as on Earth) the magnetic pole does not line up with the axis of rotation, this immensely powerful beam of radiation sweeps around space like a lighthouse beacon. If the beam happens to sweep past Earth, we detect a pulse—one pulse for each rotation of the neutron star. Thus Bell’s LGM-1 was rotating once each 1.33 seconds. Scientists soon accepted Gold’s explanation.

Over the years since, astronomers have discovered hundreds of neutron stars, but the objects still remain profoundly mysterious. Measuring their properties is difficult, if not impossible, so no one can say for sure what the stars are made of.

Lack of hard data hasn’t stopped theoretical physicists, of course. They calculate that at least in their crusts, neutron stars contain neutrons packed together at roughly the same density as they’re found in an atomic nucleus, which is the densest speck of matter on Earth.

But deep in the interior of these weird objects, conditions are so extreme that they can’t be replicated in earthly laboratories. Some physicists say that the cores of neutron stars are so dense—up to 10 times denser than their neutron packed surface—that extreme pressures might create new forms of matter not seen since the first fraction of a second after the Big Bang created the universe.

Does this mysterious stuff really exist? No one knows, but one FSU astrophysicist thinks he may have found the best way to find out.

**CLUES IN A FISH SINKER**

Jorge Piekarewicz, a theoretical physicist, and his collaborator Charles Horowitz of Indiana University, say they may have found a way to cut through the thicket of speculations and tell—with a few good measurements—whether or not the cores of neutron stars contain the kind of exotic material physicists have speculated about.

These blinding beams of energy, which can generate the equivalent intensity of a billion stars for a solid month, have been recorded by human sky gazers since at least 1952.

If the original stars were originally around 10 times the mass of Earth’s sun, one of the main pieces of debris from a supernova blast typically takes the form of a neutron star—a super-hot, hyper-condensed ball of almost solid neutrons. These objects typically spin on their axes at incredibly high rates (up to 1,000 revolutions a second) and are more than 10 or so miles in diameter yet weigh millions of times more than Earth.

Astrophysicists speculate that the pressures at the cores of neutron stars are so immense that not even neutrons can exist. The cores may be made up of nothing but fragments of “mashed” neutrons, a mixture of different types of subatomic particles called quarks. Such “quark soup” is the stuff that astronomers speculate existed in the first fraction of a second after the Big Bang.

If true, then neutron stars may hold within them the only remaining pieces—outside the confines of exotic physics experiments on Earth—of the original fabric of the universe.

When really big stars die, they go for drama on a truly cosmic scale. After millions of years burning the helium fuel within their cores, eventually their nuclear furnaces exhaust the helium supplies and turn to heavier elements such as carbon. Eventually everything in these giants gets consumed and turned into iron, an extremely stable element that resists nuclear burning. Starved for heat, the star’s nuclear furnaces shut down, triggering the creation of a solid iron core that is almost as dense as the core of an atomic nucleus. Continuing collapse of matter into this super-dense core soon sets off a cataclysmic explosion known as a supernova.

**The Anatomy of a Neutron Star**

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"...and his collaborator Charles Horowitz..."

**Figure 1**

**Figure 2**

**Figure 1**

**Figure 2**


**ILLUSTRATION: B R U C E  H A L L**

**Some, but not all, neutron stars emit vast amounts of energy in cone-like “broadcasts” from their magnetic poles. Because the stars rotate, these signals show up as regular pulses on Earth’s receiving radars, hence the stars’ other name—pulsars (“pulsating stars”).**