member of the club," Brinkman says.

Indeed, Du Pont's payments to the University of Houston, which could reach $5.5 million if the Y-Ba-Cu-O material proves valuable, are little more than entrance fees to that club. Ed Mead, Du Pont's manager of business development, explained that the company had not done any of the early work on the superconductor and it was worried about being blocked from commercial applications by companies such as AT&T and IBM, which would hold many of the important patents.

The fight over patent rights to the Y-Ba-Cu-O superconductor may not be over with the settlement of this interference, for there is at least one more controversy on the horizon. The University of Alabama in Huntsville collaborated with the University of Houston in the search for the superconductor, and it was Maw-Kuen Wu and coworkers at the Alabama school who first synthesized the material and found it to be superconducting at 90 K. But when the University of Houston filed its patent application, it ignored the other school's contribution, and Alabama later filed a separate patent application. Bob Rieder, counsel for the University of Alabama in Huntsville, says, "We expect the interference to be declared any day."

Are there any lessons in this for scientists who make patentable discoveries? One thing is clear from the University of Houston's experience with the patent interference: Commercial interests often clash with the desire of scientists to announce results as quickly as possible. "If Paul Chu hadn't published this, he could have filed a second application 6 months later when it was completely characterized," says Chuck Guenzer, a patent attorney for Bellcore. "The typical patent attorney would prefer no publication at all." In reality, most superconductivity researchers agree that if Chu had not announced his discovery, someone else would have discovered the same material within a matter of weeks. But Guenzer's point is still valid: In terms of patents, the smartest thing to do with a major discovery is to hold off announcing it for as long as possible while doing further research.

If for some reason the Patent Office does not give the University of Houston the proper credit for its work, it could be "chilling to open and free scientific discussion," says Bob Hazen, the Carnegie Institution researcher who determined the structure of the Y-Ba-Cu-O material for Chu. Already there are some industrial labs where the company's patent office will sit on an invention for years, and no one wants to see that attitude move into universities.

■ **ROBERT POOL**

A Surprise Near Virgo

In a supposedly blank part of the sky south of the cluster of galaxies in the constellation Virgo, astronomers have found a giant, rotating hydrogen gas cloud—possibly an embryonic galaxy that may even now be coalescing to form stars and planets.

Cornell University astronomers Riccardo Giovanelli and Martha Haynes discovered the cloud using the 1000-foot radio telescope at the National Astronomy and Ionosphere Center in Arecibo, Puerto Rico. Their finding will appear in a future issue of *The Astrophysical Journal (Letters)*. Nearly all known galaxies formed within the first billion years of the existence of the universe—most within the first 100 million years. This means that to catch a glimpse of an evolving galaxy, astronomers have been looking at very distant objects—so far away that their light has taken nearly the age of the universe to reach Earth.

What makes the cloud discovered by Giovanelli and Haynes so remarkable is that it is almost next door in intergalactic terms: just 20 megaparsecs (or 65 million light-years) away.

"It is an exceedingly fascinating object," says astrophysicist James Gunn of Princeton University, "because it looks like the first bona fide, galaxy-sized thing that is just now collapsing out of the expansion [of the universe]."

The newly discovered gas cloud has a mass about one tenth that of the Milky Way, but is about ten times larger—some 200 kiloparsecs in diameter. The cloud is elliptical in shape, with two large clumps of gas that may be merging, but there is no evidence that stars have already formed. It is rotating extremely slowly—one revolution would take approximately 10 billion years—which gives a clue to its age.

"For something that is going that slowly, it either has to have taken that long to form," says Gunn, "or you require some kind of deus ex machina to have put the thing down originally in this state rotating just right." He says that most galaxy formation theories predict that gas clouds will start rotating slowly and speed up as they shrink to the point where the centrifugal force is large enough to overcome gravity. "To collapse to that state and 'spin them up' takes at least as long as the rotation time, and sometimes longer," he says. "So it says that this thing that they have found has not even finished yet . . . it's just getting itself together."

Many astronomers—including Giovanelli and Haynes—have been skeptical about the existence of intergalactic clouds. About 15 years ago, radio astronomers made a systematic search for such optically invisible clouds after theorists speculated that they might account for the missing mass of the universe. But the search proved fruitless and the theory fell out of favor.

"I spent my Ph.D. thesis looking for these and I never found anything," Haynes says. So when she and Giovanelli picked up a strange signal coming from a supposedly empty part of the sky, they thought it was spurious. "We thought 'something is wrong, we looked in the wrong position.' It happens so often that [a peculiar signal] is just interference or something has gone wrong or you've made a mistake. You don't get too excited about it until you see it again."

A second look convinced them something was there, but what? "Riccardo said, 'Ah, it's an intergalactic cloud,' " Haynes recalls, "and I said, 'No, I don't believe in them. They can't exist. It's against my religion. How can you do this to me?' "

Haynes says that although the space where the cloud was found is locally isolated, "if you look on a larger scale, around 10 or 20 megaparsecs, there is a higher concentration of galaxies along what we call the supergalactic plane. And this looks like it's in a little pocket of nothingness in the clustering of galaxies in the supergalactic plane."

Giovanelli and Haynes plan further radio astronomy observations of the cloud this year and optical observations next winter and spring when Virgo rises into the nighttime sky. They will also search for more such clouds to get a better idea of how important a role they play in the evolving universe. "They seem to be telling us something about the fact that the galaxy formation process, especially for rotating disks, is a process that can occur over a long interval of time in the history of the universe, not necessarily at one magic time," says Giovanelli.

"I'm very excited about it," says Gunn. "It is going to be a kind of Rosetta stone for galaxy formation."

■ **JOSEPH PALCA**