Stellar Mystery Solved

When astronomers discovered main sequence stars rich in carbon, they were puzzled. Main sequence stars can't produce carbon. Recent studies have shown, though, that these red, faint dwarf stars do not produce the carbon; they receive it from a giant-star companion.

Two clues led to this conclusion by Paul Green of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, and Bruce Margon of the University of Washington in Seattle. One was that the stars were also rich in barium and the other that they had strong concentrations of different isotopes of carbon (isotopes of an element contain the same number of protons but differing numbers of neutrons in their nuclei).

These two clues also appear in other stars that are known to have had mass transferred to them. The astronomers suggest in the March 10, 1994 issue of the *Astrophysical Journal* that a dwarf carbon star starts as a normal main sequence star in a binary system. Then the star's companion becomes a giant star and in its bloated state transfers mass to the dwarf, enriching its carbon supply. The giant then becomes a white dwarf. The white dwarf escapes detection by astronomers because it lies far from the dwarf carbon star.

Antonella Nota (STScI/ESA) and NASA

BUBBLES OF DUST surround AG Carinae, a luminous blue variable star that is among the brightest and most massive stars in our Galaxy. The dust had been seen before by ground-based telescopes, but it wasn't resolved and appeared to be a jet. This new image, from HST's Wide Field/Planetary Camera 2, resolves the "jet" into a complex structure of bubbles, arches, and filaments. Dust is highly unusual around stars as hot as AG Car, which has a surface temperature of 30,000 kelvins. Astronomers think the dust may be a relic from the star's previous red supergiant phase that has been pushed away from AG Car by the star's 70 km/sec stellar wind.

Dusty Birth Announcement

Dust surrounding a distant quasar may be the earliest sign yet found of a newborn galaxy, says a team of astronomers from the United Kingdom, France, and Germany. The team was observing the quasar BR 1202 −0727 in Virgo at a radio wavelength of 1 millimeter when their instrument picked up signals from a dust cloud with about 100 million times the mass of the Sun surrounding the quasar.

Astronomers think the dust cloud is part of an unseen larger galaxy whose active core is the quasar. The dust cloud might contain as many as a million million solar masses. Such dust clouds typically are rich stellar "nurseries" where stars form at a rapid pace.

"We may be seeing this quasar and its surrounding galaxy only a few hundred million years after it switched on," says Richard McMahon, a team member at the University of Cambridge. "If so, then the galaxy's light may just now be shining through the dusty cloud that covered it while it was forming."

The quasar has a redshift (z) of 4.69, which places it at a distance of 12 billion light-years. The signals originated when the universe was about 1 billion years old.

SERENDIP Hopes For Lively Reruns

Because it spreads like an expanding bubble into the cosmos, humankind's electromagnetic clutter could serve as a clarion call to any extraterrestrial civilization listening for proof they're not alone in the Galaxy. If it would work for them, why not us? Hoping that's just the case, a team at the University of California at Berkeley is searching the radio sky for signs of intelligent extraterrestrial life.

Since 1980, Project SERENDIP (Search for Extraterrestrial Radio Emissions from Nearby Developed Intelligent Populations) has spent 3,600 hours scanning and recording more than 110 million radio signals between 424 and 436 megahertz, frequencies most commonly found in UHF-TV, radar, and other communication channels. Radio signals in this band continually escape from Earth, making us detectable to anyone searching for our presence. The Berkeley group is looking for similar signals that may have leaked from planets with technological civilizations much like Earth's.

Scientists conduct SERENDIP's search with instruments piggybacked on other experiments mounted to the 1,000-foot radio telescope at Arecibo, Puerto Rico. Since Arecibo is used around the clock by guest astronomers, SERENDIP is able to operate 24 hours a day, recording and analyzing data. Computer software specially designed for the effort monitors 4 million radio frequencies every 1.7 seconds. Candidate signals are stored for further analysis at Berkeley. Later this year, the project will get its next generation of instruments, capable of analyzing 120 million radio channels simultaneously.

"The hope is that other intelligent civilizations are either leaking radio waves from their own communication," says Dan Werthimer, electrical engineer and program manager of the project, "or sending out a signal on purpose, either directly to us, or omni-directionally in an 'Is anyone out there?' kind of signal." — *Cynthia Scanlon*