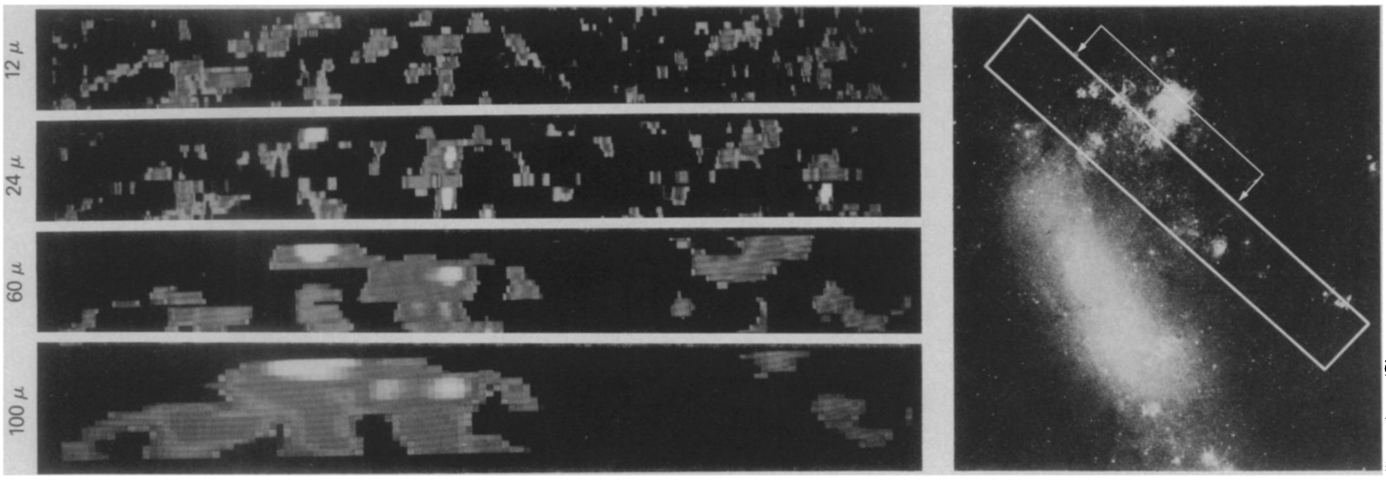
Starbirth: An infrared look from conception to delivery



Illustrations: JPL

Drawn inward by its own gravity, a vast cloud of dust and gas begins to condense, warming from the growing pressure. Smaller, denser and hotter it becomes, culminating in the ignition of thermonuclear fires at its heart. A star is born.

The prenatal stages of its development pass unseen by visible light, but their heat produces the longer wavelengths detectable by such tools as the U.S./Dutch/British Infrared Astronomy Satellite (IRAS), launched Jan. 25 (SN: 2/12/83, p. 101). During its earliest observations, IRAS swept its telescope across a galaxy called the Large Magellanic Cloud, the nearest galaxy to our own Milky Way, and promptly provided an almost textbook example, step by step, of stars in formation.

The telescope carries four sets of infrared detectors, centered at wavelengths of 100, 60, 24 and 12 microns to simultaneously record emissions of increasing warmth. The four scans shown (above left) represent, at those wavelengths, the portion of the Large Magellanic Cloud indicated by the bracketed section of the box in the conventional, earth-based photo at right. (The scans as shown appear exaggerated in width, which will be corrected in later computer processing.) Shades of gray represent different intensities at each wavelength, with white as "brightest."

In the 100-micron scan, at bottom, says B. Tom Soifer of California Institute of Technology, "what we believe that we're seeing is . . . the coldest, most diffuse material, that material which is in the form of molecular clouds . . . perhaps just deciding that it's time to start collapsing and form stars." Moving up the picture, the 60-micron scan shows the same scene at the same time, but by the warmer emissions of those objects in the area that have condensed into more compact structures. At still shorter wavelengths, says Soifer, the progression continues, until, "by the time one gets to the shortest wavelength, 12 microns, we're seeing the radiation that is being emitted from very warm, compact objects . . . condensations that are very likely to be stars that have just formed." The visible light of such fledgling stars may be too faint to penetrate the dust that still surrounds them, but they heat the dust, which re-radiates the energy at the long wavelengths IRAS can see.

Identifying such a process in the Large Magellanic Cloud is no surprise by itself— "what we see here, actually," Soifer says, "is what we suspected we would see: a region of very active star formation" — but the job of IRAS is to make the first survey of the entire IR sky, about which far less is known. The swath through the Large Magellanic Cloud took barely a minute of the satellite's time, and Soifer notes that it has already provided "more information about the infrared properties of [the cloud] than all previous observations." More data may allow measurement of the rate at which new stars are born.

—J. Eberhart

The Search for Extraterrestrial Intelligence: Living in a suitcase

The Search for Extraterrestrial Intelligence (SETI) will take its next step on March 7, when an 84-foot radio telescope in Harvard, Mass., is started on a years-long, round-the-clock project to listen for artificially produced signals from the vicinities of distant stars.

The telescope will be equipped with the "Suitcase SETI," a frequency analyzer capable of dividing what the telescope "hears" into 131,072 separate, extremely narrow frequency bands. The idea is to find out whether any of the bands are unusually strong or carry unexpected kinds of pulsations, on the chance that they might represent attempts at communication by an extraterrestrial civilization.

The Suitcase SETI was developed by Paul Horowitz of Harvard University, together with colleagues from Stanford University and the NASA Ames Research Center in California. The device's development and operation are being funded by a grant from the Planetary Society, a private organization started by Carl Sagan of Cornell University and Bruce Murray, former director of Jet Propulsion Laboratory. The plan came into being when a SETI effort being conducted by NASA had its funding cut short by Congress, although the NASA project has since been reinstated. The radio telescope, at what Harvard now calls its Oak Ridge Observatory, had not been in use for several years ("they were ready to board up the building and take everything out of there," Horowitz says), but the nearly automatic operation of it and the Suitcase SETI is expected to cost only about $20,000 a year.

The instrument will survey about 68 percent of the sky, scanning from $-30°$ to $+60°$ in declination at a succession of the so-called "magic frequencies." This is SETI jargon for a group of frequencies emitted by atomic or molecular clouds in interstellar space; a number of researchers have reasoned that these frequencies would be known to any civilization advanced enough to have radio astronomy, and that, if representatives of such a civilization wished to send a recognition signal, they would be likely to use those frequencies in the hope that any listeners would be doing the same. The Suitcase SETI project will scan the sky successively at each chosen frequency, Horowitz says, probably requiring a total of four to five years.

Under development at NASA, meanwhile, is a frequency analyzer whose designers hope it will ultimately evolve into a version capable of monitoring not just 131,072 channels, but 8 million, and over a wider frequency range. Its channels, however, will have only about 1-kHz resolution, compared to the Suitcase's 0.03 Hz.

—J. Eberhart, D. E. Thomsen