Windows on where a star is born

Astronomers usually observe young stars in and about the spiral arms of galaxies, but they have argued whether these stellar infants are created by the spiral arms or form between arms and later collect there. Now, by pairing radio and optical observations of M51 — a typical spiral galaxy — a trio of astronomers has acquired "strong evidence" indicating a spiral galaxy's arms can directly trigger star formation.

Stars form as gravity forces clouds of molecular gas within a galaxy to collapse slowly upon themselves. In the Aug. 4 NATURE, Stuart N. Vogel of Rensselaer Polytechnic Institute in Troy, N.Y., and colleagues at the California Institute of Technology in Pasadena report the first wide-scale mapping of molecular gas in a classic spiral galaxy "with sufficient resolution to resolve the molecular cloud complexes and their streaming motions."

Although hydrogen is the most common molecule in these gas clouds, the scientists focused their radio observations on carbon monoxide. Except where stars are actually forming, the hydrogen in molecular clouds is too cold to be visible, Vogel explains. But carbon monoxide, a trace constituent of hydrogen clouds, offers "an easily observable signal." To locate these clouds, the researchers superimposed radio maps of the carbon monoxide sources over visible images of M51 made at the 60-inch Mt. Palomar telescope in California.

The strongest carbon monoxide emissions came from lanes of dust centered within M51's spiral arms. The emissions also showed that the gas clouds slow in velocity as they enter and move through the spiral arms. Vogel says this indicates that gas clouds — which ordinarily rotate around the galactic center faster than the spiral arms — tend to "pile up in the dust lanes" as they attempt to flow through the slower arms. It's a bit like a slow truck on a two-lane highway causing faster vehicles to slow and cluster as they pass the truck, he notes.

Finally, emissions of ionized hydrogen showed up downstream from the dust lanes, signaling the formation there of massive, young, hot stars. That this happens downstream suggests that the compression necessary to initiate star formation occurs where the clouds collide, Vogel says — in the spiral arms.

"We were able to show quantitatively that the gas in the spiral arm is much more efficient at making stars than the gas between the spiral arms," Vogel says — about three times more efficient. However, he points out, stars do form in galaxies with no discernible "arms." This indicates arms are not a requirement, he adds, just a facilitator. *— J. Raloff*

One-third of pregnancies may miscarry

A new study indicates 31 percent of all successful fertilizations end in miscarriages, two-thirds of which occur before a woman or her physician becomes aware of the pregnancy.

Using refined early detection methods, eight scientists from the National Institute of Environmental Sciences in Research Triangle Park, N.C., and the College of Physicians and Surgeons at Columbia University in New York City tested daily urine samples from 221 healthy women attempting to conceive. The women's ages ranged from 21 to 42. Over the course of the study, the researchers found 198 pregnancies by testing for the level of human chorionic gonadotropin (hCG), a hormone produced by an egg about one week after fertilization. The level of hCG in the urine and bloodstream is a standard indication of pregnancy.

"Most of these early pregnancy losses would not have been detectable by the less sensitive assay for hCG used in earlier studies," the researchers state in the July 28 NEW ENGLAND JOURNAL OF MEDICINE. However, two of the three previous studies by other groups using hCG to detect pregnancy actually yielded higher estimates of early miscarriage. "This difference may reflect a lack of specificity in the assays used in the other studies," suggest the authors of the recent report, saying the presence of a similar steroid hormone sometimes gives a false indication of pregnancy in less sensitive tests.

With a method of detecting pregnancy after one week, epidemiologists can more precisely follow the effects of certain environmental conditions, such as radiation or toxins, on pregnancy. "There is now a method for looking at the episode of early pregnancy," says Allen Wilcox, the study's principal author. "That period has always been a black box."

Almost all women who had miscarried showed signs of high fertility just after the loss, with one-third of them conceiving in the next menstrual cycle. Within two years, 95 percent of the miscarriage group had normal pregnancies, carried to term.

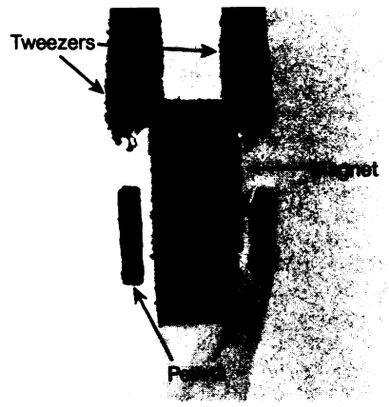
"Even when it fails, early pregnancy is apparently a positive sign that the stages of reproduction leading to implantation are correct," the researchers observe. They suggest rethinking the current clinical practice in which women are advised to resume birth control just after miscarriage to give the uterus time to recover. *— L. Beil*

Hanging by a magnetic thread

The sight of a superconducting pellet floating above the surface of a magnet is a striking demonstration that superconductors repel magnets. Now two research groups report that it's possible to suspend a superconducting pellet below or to either side of a magnet (see photo). The observation of this unusual type of levitation suggests the presence of an attractive force in addition to the normal repulsive interaction between superconductors and magnets.

"It's a curious and interesting effect," says Allen M. Hermann of the University of Arkansas in Fayetteville. Hermann and his colleagues demonstrated the effect in a thallium-based superconducting compound (SN: 4/2/88, p.213). A team including scientists from NASA's Marshall Space Flight Center in Huntsville, Ala., has observed similar behavior in a superconductor made from yttrium-barium-copper oxide mixed with silver oxide. Both groups will report their findings in APPLIED PHYSICS LETTERS.

The unusual levitation effect appears to arise because the magnet's field penetrates certain types of superconductors, generating currents within the material. However, because the superconducting material contains impurities, these currents and the magnetic field they generate somehow become trapped. Hence, the superconductor retains this induced magnetic field. With a magnet nearby, the result is both an attractive and a repulsive interaction that combine to keep the superconductor a certain distance away from the magnet.



Univ. of Arkansas

"To calculate that effect and make it a quantitative explanation is extremely difficult and probably impossible," says Hermann. "It's not so much a question of computational difficulty. It's that we don't know the configuration of how the [magnetic field] threads itself around inside the superconductor." *— I. Peterson*