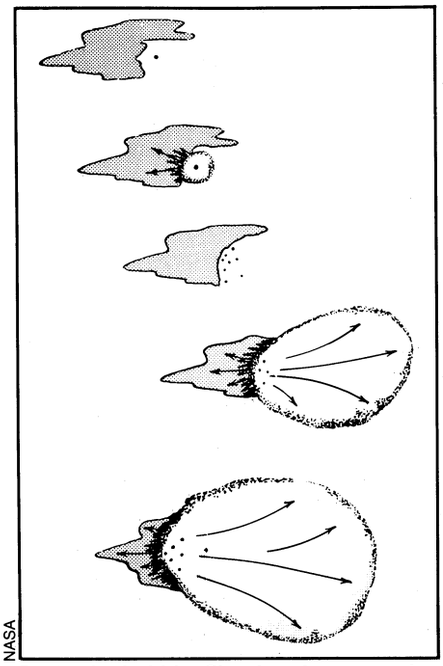
The great Cygnus Loop bubble

The amounts of energy involved in astrophysical processes are so far above the range that human beings are accustomed to, let alone comfortable with, that the numbers tend to become meaningless, astronomical numbers in the purest definition. Now we are asked to take in one of the biggest of all, 10^{52} ergs, or 10 to 20 times the energy output of the sun since the sun's formation, some 5 billion years ago. "Nothing else in the galaxy has that much energy locked up in a single feature," says one of its discoverers, Webster Cash of the University of Colorado.

The feature is a bubble, or superbubble, in the interstellar matter of the galaxy. The center of the superbubble lies behind the dark cloud known as the Rift in the Great Loop in the constellation Cygnus. Cash and co-investigator Philip Charles of the University of California at Berkeley found it from data recorded by the first High Energy Astrophysical Observatory satellite. They reported the superbubble's existence at the meeting in San Francisco last week of the American Astronomical Society. The superbubble is a rarefaction in the interstellar matter about 450 parsecs in diameter, lying about 2,000 parsecs away. The gaseous matter in it has a temperature of about 2 million degrees K. Cash and Charles explained the inability to observe such a thing optically by the obscuring power of the dense matter in the Rift, which absorbs the light of the young stars they believe it contains, and a very efficient cooling mechanism for the gas, which leads the gas to emit mostly X-rays. If the Rift cloud were not there, they estimate the young stars in the superbubble would have a prominence similar to that of the Pleiades.

To blow such a bubble in the galaxy — it amounts to about $^1/_{2,500}$ of the entire galactic disc — takes a push that is large even by the standards of astrophysics. A supernova, the most spectacular visible explosion in the galaxy, produces only 3 percent of the necessary energy. Cash and Charles first tried to account for the necessary energy by postulating a single giant sharp explosion of the sort that the Soviet astronomer I.S. Shklovsky has suggested might have occurred from time to time, but the idea wouldn't work. With a Shklovsky explosion the bubble would have to be only 100,000 years old. There is spectroscopic evidence that it is much older. To inflate and maintain the bubble for a long time, astronomically speaking, required a gentle blowing, a kind of putt-putt effect. So Cash and Charles came to the hypothesis of a chain of supernovas. That makes the dense matter in the Rift cloud essential to the scenario. It began with a single supernova exploding on the edge of the Rift cloud about 3 million years ago. The explosion sent a shock wave into the dark cloud. In the shock, new stars formed. Several of these grew up to be supernovas. Their explosions sent new shocks into the dense interstellar matter. A next generation, and a next and gradually a large bubble was excavated.



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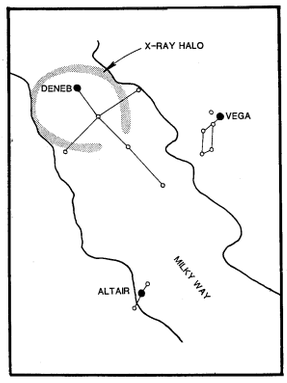
Birth of a bubble: Cloud and star; star becomes supernova and shock wave strikes cloud; new stars form from cloud; stars become supernovas and create a bubble, which starts to inflate; and finally as more stars are formed, the superbubble grows larger. X-ray halo of the Northern Cross (right) shows location of superbubble.



The sun could have been formed on the edge of such a bubble, Cash and Charles speculate. The Cygnus Loop area is not unique. Conditions in many other parts of the galaxy are right for the formation of similar bubbles. "About 10 percent of the entire galactic disc may be locked into bubbles like this," Cash speculates. They would be important centers of star formation.

The bubbles would thus be important in the dynamics and evolution of the galaxy. And if they are important in our galaxy, they should also be significant in the economy of galaxies where conditions are similar to those in ours. Cash and Charles say their next project is to look for evidence of a superbubble in the great Andromeda nebula. □

Psychosis: Is the 'cure' a cause?

A well-documented, troublesome side effect of antipsychotic drugs is the development of tardive dyskinesia — involuntary twitching of the face, tongue, arms and legs — among a substantial number of patients who receive such drugs over varying lengths of time. Many researchers believe dyskinesia occurs as a result of the brain's overcompensation for the drug's therapeutic action, the blocking of cells that normally receive the chemical transmitter dopamine (a prevailing theory suggests that schizophrenia somehow involves an overactive dopamine system). In reaction to the blocking drug, according to the hypothesis, the brain may become "supersensitive" to dopamine and actually grow new dopamine receptors in a specific region, the neostriatum; the primary result of this overcompensation is tardive dyskinesia.

A parallel but perhaps more serious consequence of such "neuroleptic" medication, however, may have been discovered by psychiatrists at McGill University in Montreal. The researchers report in the January AMERICAN JOURNAL OF PSYCHIATRY that neuroleptic drugs may trigger a dopamine supersensitivity similar to that in dyskinesia, but in the brain's mesolimbic region — an area involved primarily in emotional reactions.

As a result, schizophrenic patients who receive antipsychotic drugs for months or years may be at risk of developing a psychosis — separate from their original ailment — that appears to be *caused* by the substance used to help them in the first place. And unless detected early, this drug-induced psychosis can become a permanent condition, report Guy Chouinard and Barry D. Jones.

Ironically, say the researchers, the only apparent way to treat the psychosis "is [with] the causative agent itself, the neuroleptic." Psychotic symptoms — suspiciousness, delusions or hallucinations — surface when the drugs are discontinued or the dosage decreased. In addition, a growing tolerance to the drug dictates that "a gradual increase in neuroleptic dosage is necessary to maintain a therapeutic effect."

The results of their latest study of 10 schizophrenics — a follow up to earlier work with close to 100 patients — indicate that certain patients who take such standard, prescribed drugs for psychoses may find themselves in an "irreversible" vicious circle where the chances of a relapse are great should they discontinue drug treatment.

"... the result would be," the psychiatrists say, "patients who must remain on neuroleptics for the rest of their life regardless of the natural course of their illness." □