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NASA PROPOSES GAMMA RAY SATELLITE

The Gamma Ray Observatory, a proposed new start in NASA's fiscal 1981 budget, is designed to explore sources of gamma rays in space -- the most energetic form of radiation known.

The Earth-orbiting observatory, planned for launch in 1985, will carry instruments which will detect gamma rays in a variety of forms -- very high energy gamma rays from pulsars, nuclear gamma rays and gamma ray bursts.

Information returned is expected to provide a much deeper understanding of the nature of supernovas, pulsars, quasars and radio galaxies (see glossary), the character of the universe at an early time, and the possible existence of antimatter in the universe.

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Scientists also hope to learn more about the incredibly dense matter which makes up such objects as neutron stars -- matter so compressed that a teaspoonful of it would weigh millions of tons.

The data may also shed more light on the nature of gamma ray bursts -- erratic pulses of gamma rays that appear every month or so and flash across the solar system. Their origin is a mystery.

Like X-rays, gamma rays are a form of electromagnetic radiation (as is ordinary light), but they have extremely high energy and correspondingly short wavelengths (less than 10^{-11} centimeters). At maximum strength, a gamma ray unit packs several million times as much energy as a comparable unit of visible light.

Unlike X-rays, however, which are typically emitted by hot gas, gamma rays are believed to come from the core of the phenomenon, produced by special nuclear processes. Gamma ray astronomy allows scientists to investigate these special processes.

Until recently all astronomy observations were of atoms, ions and molecules, and their emissions. Gamma rays were recognized after World War II as an important aspect of space research, but work in this field was slow.

A long program of balloon research proved rather disappointing, with only hints that gamma ray sources were being detected.

Then a small experiment on an Orbiting Solar Observatory detected the first certain gamma rays. This gave scientists the confidence to launch in 1972 the Small Astronomy Satellite-2 with a small detector for very high energy gamma rays. This spacecraft, along with the European spacecraft COS-B (1975), and the first High Energy Astronomy Observatory, provided the basic data which will be exploited by the more powerful Gamma Ray Observatory.

The observatory will be managed by NASA's Goddard Space Flight Center, Greenbelt, Md. The satellite will be carried into a planned orbit of 400 to 500 kilometers (250 to 300 miles) by the Space Shuttle. Launch will be from Cape Canaveral, Fla.

The planned orbital altitude was chosen to be as low as possible consistent with the observatory's two-year design lifetime.

GLOSSARY

Supernovas

A supernova is a large star at life's end, whose final collapse is a cataclysmic event that generates a violent explosion, blowing the core of the star out to space. There the material of the exploded star mixes with the primeval hydrogen of the universe. Later in the history of the galaxy, other stars are formed out of this mixture. The Sun is one of these stars. It contains the debris of countless others that exploded before the Sun was born. The last supernova observed in the Milky Way Galaxy -- of which our solar system is a part -- was seen by Johannes Kepler in 1604. Supernova explosions, resulting in neutron stars and black holes, occur with massive stars. Stars smaller than, say, our Sun -- which is an average size star -- probably become white dwarfs.

Pulsars and Neutron Stars

Discovered in 1967, pulsars emit radio signals whose pulsations are extremely precise. The evidence suggests that pulsars are fast-spinning neutron stars. These are compact bodies of densely packed neutrons (atomic particles having no electric charge), believed to form when a large star burns up its fuel and collapses.

Containing the mass of a star in a sphere 16 km (10 mi.) in diameter, their matter is so closely packed that a spoonful of material from the center would weigh a billion tons. A neutron star, or pulsar, has been located in the center of the Crab Nebula, a glowing cloud which is still expanding from a supernova reported by the Chinese in 1054.

Quasars

Astronomers are still baffled by the nature of quasars, but many believe that among observable objects they are the most remote in the universe. They look like stars when viewed through an optical telescope, but emit more energy at radio frequencies than the most powerful galaxies known. According to calculations, if they are as distant as many astronomers think they are, the total amount of energy emitted by a quasar in one second (10^{47} ergs/sec) would supply all of Earth's electrical energy needs for a billion years.

Radio Galaxies

Radio galaxies, from the fringes of visibility, emit radic waves millions of times more powerful than the emissions of a normal spiral galaxy. Nobody knows what these peculiar galaxies are. Several of them broadcast with such huge power that a sizeable fraction of the nuclear energy locked up in their matter must be going completely into the production of radio waves.

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