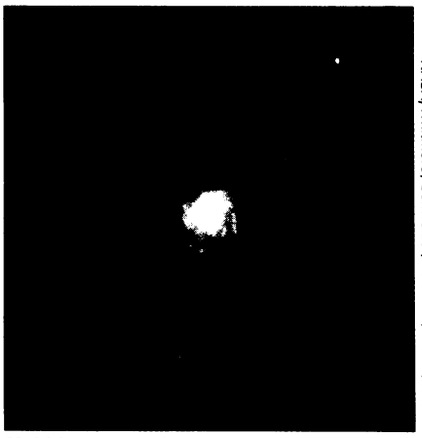


NASA/Whitmore, Schweizer, Leitherer, Borne, Robert

Hubble space telescope image shows mini-spiral structure and dozens of hot, young star clusters in the heart of the elliptical galaxy NGC 7252.

"mini-spiral," as Whitmore calls it, measures 1/20 of the diameter of NGC 7252 and, in an unprecedented twist, rotates counter to the rest of the galaxy.

The astronomers also found at least 40 tightly packed, spherical knots of stars, called globular clusters, speckling the galaxy's central pinwheel. These young, blue clusters, previously detected with ground-based instruments but not seen clearly until now, provide a key piece of evidence for the merger theory. The clusters appear to be 50 to 500 million years old – too young to have originated in the parental spiral galaxies. Thus, the clusters must have formed in the merger itself, says Whitmore.

About a billion years ago, Whitmore explains, two spiral galaxies had a fateful encounter where NGC 7252 now lies, some 300 million light-years from Earth in the constellation Aquarius. As the spinning galaxies merged, a powerful gravitational tug-of-war ensued among their billions of stars, tearing the spirals apart. Currents of gas streamed into the center of the merging mass, creating the swirling mini-spiral in the core of NGC 7252. This inrush of gas also created millions of stars, which gravitated together in dense clusters.

The new observations, says Jon A. Holtzman of Lowell Observatory in Flagstaff, Ariz., will help resolve the main objection to the merger theory: that ellipticals contain more clusters than expected from the simple addition of spiral galaxies. The Hubble images suggest that cluster birth may be a *consequence* of the merger process, says Holtzman, who has conducted similar research on the elliptical galaxy NGC 1275 (SN: 1/25/92, p.52).

Holtzman cautions, however, that "one case does not an entire theory prove." Both he and Whitmore emphasize that more work is needed to explain the physics of how new clusters form in mergers. Astronomers must also find more examples of the phenomenon. Only then might they agree that spiral mergers account for some elliptical galaxies. *– D. Pendick*

New radiation belt spotted around Earth

A joint U.S.-German satellite launched last year has identified a belt of radiation around Earth that holds an unusual collection of matter from outside the solar system. The discovery of these exotic ions trapped in orbit provides an opportunity to study the environment beyond our solar system without having to leave Earth's own backyard, say space scientists who announced the findings last week in Baltimore at a meeting of the American Geophysical Union.

"What's exciting about this is that it's a sample of matter from a place that we'd like to be able to study. We'll be able to do it because it's right here," says Jay R. Cummings, a member of the satellite team and a space physicist at the California Institute of Technology in Pasadena.

The new information comes from measurements made by the Solar, Anomalous, and Magnetospheric Particle Explorer (SAMPEX), the first of a trio of small, quickly built satellites that NASA hopes will bypass the normally plodding process that can take a decade from planning to launch. SAMPEX circles the Earth at an altitude of 600 kilometers.

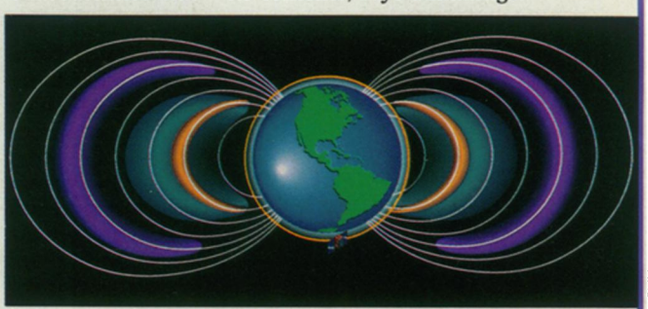
The radiation belt identified by SAMPEX joins two others that were discovered in 1958 by physicist James A. Van Allen of the University of Iowa in Iowa City. All three belts hold electrically charged particles that have become trapped by Earth's magnetic field. The outer Van Allen belt contains mostly energetic electrons, while the inner Van Allen holds mostly fast-moving protons. The newly discovered belt resides within the inner Van Allen belt and stores energetic ions of oxygen, nitrogen, and neon, says SAMPEX scientist Richard A. Mewaldt of Caltech.

The scientists believe this collection of ions is a trapped form of so-called anomalous cosmic rays. Unusual because of their composition and charge, such rays are born in a complex process that starts outside the solar system in the interstellar medium, which contains debris from supernovas, remnants of the Big Bang, and other matter.

As our solar system moves through the interstellar medium, the flow of protons emanating from the sun pushes aside any charged particles. But this solar wind does not affect neutral elements, which can slip into the solar system. As the elements drift toward the sun, solar radiation bombards them, stripping one electron from each and forming ions. These ions feel the push of the solar wind and are carried to the edge of the solar system. There they hit a magnetic shock wave that energizes them and forms the anomalous cosmic rays, some of which head toward Earth.

In 1977, J. Bernard Blake and Lynn T. Friesen of The Aerospace Corporation in El Segundo, Calif., proposed that such anomalous cosmic rays could become trapped in Earth's magnetic field if they passed close enough to hit atmospheric particles and lose all of their electrons. Once stripped, the ions would fly between magnetic poles, spiraling around the magnetic field lines.

Data collected in the late 1980s by Soviet COSMOS satellites first detected signs of such cosmic rays trapped in a radiation belt around Earth. But those measurements could not identify the precise location of the belt or much of its contents, says Cummings.



NASA

Newly discovered radiation belt (yellow) sits within inner Van Allen belt (blue). Outer Van Allen belt shown in purple.

To its discoverers, the band of trapped cosmic rays represents a third radiation belt. But because the original Van Allen belts contain different types of particles, Van Allen himself thinks the trapped cosmic rays are one group within that inner radiation belt, he told SCIENCE NEWS. Others argue that the trapped ions constitute a new belt because they come from a different location. Many of the other belt constituents hail from Earth itself.

Beyond that nominal issue, space scientists say the discovery of trapped cosmic rays in a belt around Earth offers a unique chance to obtain samples of matter from beyond the confines of our immediate stellar environment. That's important because almost everything else within the solar system is related, having condensed from the same cloud of gas and dust 4.65 billion years ago. Says Blake, who predicted the existence of a new radiation belt, "One would like to get samples of material from elsewhere. Well, cosmic rays are messengers from a distance."

– R. Monastersky