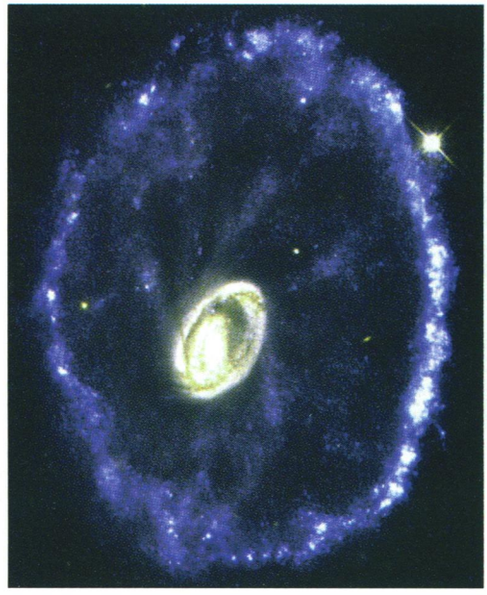
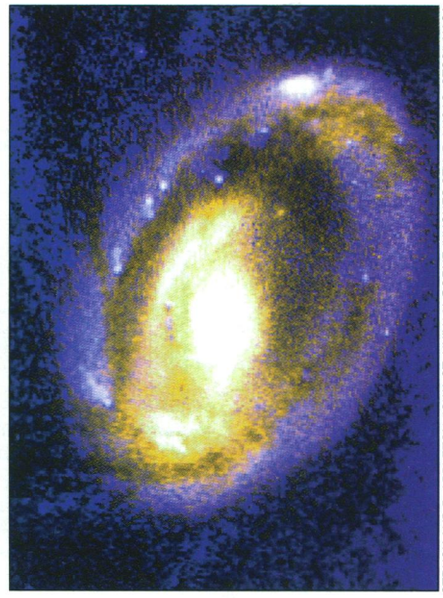
ASTRONOMY

Hubbub at a Cartwheel's Center

These dramatic images from the Hubble Space Telescope reveal what may be the aftermath of a head-on collision between two galaxies. The collision has distorted the surviving galaxy into the shape of a wagon wheel—a shape familiar to astronomers, who named it the Cartwheel Galaxy. But the detailed Hubble images also show a finer scale effect of the collision: massive balls of gas reeling like comets around the galaxy's center. These whirling megacomets, described in the November *Astronomical Journal*, may help scientists better understand the strange physics of galactic collisions.





PHOTOS BY C. STRUCK AND P. APPLETON (IOWA ST. UNIV.)/K. BORNE (HUGHES STX)/R. LUCAS (STSCI)/NASA

The Cartwheel has two bright concentric rings connected by wispy spokes (left image). Scientists think such shapes form when a smaller galaxy smashes into the center of a regular spiral galaxy. "It's like a pebble thrown into a pond," says Curt Struck of Iowa State University, a member of the imaging team. Compression waves fan outward from the impact point, forming the rings of gas, dust, and stars, Struck says. In this galaxy, the outer ring appears blue from the light of young stars, their formation triggered by the turbulence. But the inner ring is puzzlingly yellow. In spite of the turmoil, it seems to contain few young stars. Now, says Struck, the Hubble image reveals where some of the missing stars might be hiding.

Surrounding the yellow center is a ring of gas clouds that look like giant comets (right image). Their "heads" are a few hundred light-years across, and their tails are between 1000 and 5000 light-years long. The scientists think the structures might have formed from blobs of gas splashed out of the galaxy during the collision that are now falling back toward the center. The motion of each blob through the inner ring creates shock waves, says Struck: "It's the equivalent of an interstellar sonic boom," and it leaves a wake. The comet tails are blue and the heads are bright white, which to Struck indicates that they might contain the missing young stars.

But at this point, such explanations are only educated guesses, Struck says. He and his colleagues still have to analyze the spectral signatures of the megacomets to determine exactly what kinds of gas and dust they contain, he says. François Schweizer, an astronomer at the Carnegie Institution of Washington, agrees. "It's an interesting hypothesis," he says, "but there's more work to be done."

–Gretchen Vogel

ENVIRONMENT

Green Grass, Cool Climate?

Climate researchers and ecologists suspect that nitrogen, pumped into the environment from the burning of fossil fuels and the use of agricultural chemicals, is a double-edged sword. It may be "fertilizing" ecosystems, causing plants to sop up ever more carbon dioxide and slowing the atmospheric buildup of this greenhouse gas. But it also appears to favor the growth of weed plants at the expense of native species. Now a new study not only confirms this harmful ecological effect but suggests that it undermines any potential climate benefits.

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Natural state. Native prairies store more carbon in soils than do grasslands dominated by invasive species.

On page 1720, ecologists David Wedin of the University of Toronto and David Tilman of the University of Minnesota report that while, in the short term, nitrogen inputs spur growth, inducing plants to fix more carbon in their tissues, over the long term, added nitrogen indeed pushes the mix of plants toward fast-growing, invasive species that aren't efficient at fixing carbon in soils. The result: A grassland's biodiversity drops, and its overall ability to sequester carbon soon levels off. "This suggests that there are limits on how effective this added nitrogen is going to be at slowing carbon dioxide buildup," says ecologist Don DeAngelis of the U.S. Geological Survey.

Documenting long-term effects of the extra nitrogen on Earth's carbon cycle hasn't been easy. Ecologists, says DeAngelis, tend to work with "plants in a pot," which aren't very good at replicating what happens in actual ecosystems. But a research team led by Tilman devised an experimental system from three once-abandoned fields, which they divided up into 162 4-by-4-meter plots. The researchers dosed the plots with varying quantities of nitrogen fertilizer—plus lime so the nitrogen wouldn't acidify the soil—then measured changes in both plants and soils.

Over the past 15 years, the Tilman team—as well as Dutch and British groups studying heathlands—have published a number of studies that have sounded an alarm about the effects of widespread nitrogen deposition on biodiversity. To convert sunlight and carbon dioxide into carbon-based plant matter, plants need nitrogen. But as the Tilman group demonstrated, adding lots of nitrogen caused a shift from native species—such as little and big bluestem grasses, which don't need much nitrogen to