tions much simpler." As for JWST's instruments, the University of Arizona is building a near-infrared camera, ESA will provide a near-infrared spectrometer, and U.S. and European researchers will collaborate on a midinfrared camera-spectrometer.

The big surprise in NASA's announcement last week was the name. Like NASA's current Administrator Sean O'Keefe, James E. Webb (1906–1992) had a top position at the government's Office of Management and Budget (then called the Bureau of the Budget) before he led the space agency from 1961 to 1968, at the height of the moon race. NASA spokesperson Don Savage confirms rumors that the new name "originated from the current Administrator." NASA's senior JWST project scientist, John Mather of Goddard, says "this is certainly a surprising break with the tradition within NASA." But it might be no bad thing: "To me it's a clear sign that NASA is very committed to building and operating this telescope."

–GOVERT SCHILLING

Govert Schilling is an astronomy writer in Utrecht, the Netherlands.

ASTROPHYSICS

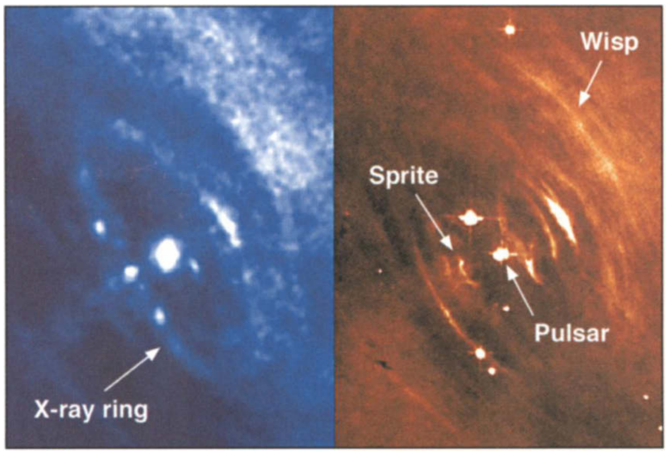
Orbiting Scopes Shoot 'Movie' of Crab Nebula

The Crab Nebula, a tangled web of cosmic debris cast off by a supernova nearly 1000 years ago, is starring in a new action-packed film. The hot fall release comes from the Hubble Space Telescope and the Chandra X-ray Observatory, which teamed up to take more than 30 images of the nebula's heart. The dynamic sequence, which spans about 8 months, is winning raves from astrophysicists who are accustomed to static snapshots or mere points of light. In the words of theorist Jonathan Arons of the University of California, Berkeley: "Wow!"

The spiky nebula is the famed remnant of a giant star that exploded when it ran out of fuel, seeding space with elements for new stars and planets. At the Crab's center a dense neutron star spins 33 times each second, unleashing pulses of radio waves, visible light, and x-rays. As it gradually slows down, this pulsar sheds energy along the axis of its intense magnetic field at a fantastic rate—equivalent to "a few thousand nuclear wars per square meter [of the pulsar's surface] per second," according to Arons. The rotation and magnetism combine to whip particles around the pulsar into a frenzy approaching the speed of light, but how that works is poorly understood.

Now, the new images have exposed jets, wisps, knots, and other features that roil the nebula's innermost cauldron, dramatically changing its shape from week to week. "This is relativistic astrophysics in action," says team leader Jeff Hester, an astronomer at Arizona State University in Tempe. "The Crab is the only object in the sky where we can watch these kinds of processes in real time."

Hubble aimed its Wide Field Planetary Camera at the nebula's core 24 times between August 2000 and April 2001, while Chandra took eight x-ray images during the same interval. Each Chandra observation consisted of about 15,000 exposures lasting an unusually short 0.2 seconds each, which prevented the bright nebula from saturating the detectors. And by gathering about five times more light per observation than previous images, Chandra revealed fainter x-ray features, says astronomer Koji Mori of Pennsylvania State University, University Park.



Heart of a crab. New images of the innermost Crab Nebula reveal fine structures in x-rays (*left*) and optical light (*right*).

CREDIT: J. HESTER *ET AL.*/CHANDRA X-RAY OBSERVATORY AND SPACE TELESCOPE SCIENCE INSTITUTE

The new images, released this week at NASA headquarters in Washington, D.C., and published in the 20 September *Astrophysical Journal Letters*, illuminate striking sets of shock waves near the pulsar. A blazing x-ray ring girdles the plane of the pulsar's equator. At that spot, says Hester, the violent but steady wind streaming from the pulsar careens into a frothy shock front of disordered electrons. The electrons emit synchrotron x-rays—as well as visible light—as they cascade around magnetic fields in the plasma. "It's no longer speculation that the synchrotron emission begins at this shock front," Hester says. "We can just see it."

Wisps of particles flit outward from the x-ray ring at half the speed of light. The wisps form crisp, narrowly defined arcs confined to the equatorial plane, probably held in place by tight lines of magnetic field whipping out from the pulsar. Meanwhile, at right angles to the plane, diffuse jets of particles blast into the nebula from the pulsar's rotation poles. The jets look like puffy plumes from industrial smokestacks on a windy day, buffeted to and fro by turbulence around them. The images show one jet plowing into slower material and triggering an amorphous shock that ebbs and flows, called the "sprite."

The different forms of the equatorial and polar shocks suggest that distinct mechanisms spew energy along those directions, says physicist Roger Romani of Stanford University in Palo Alto, California. "These structures and their variations will let us decipher or reverse-engineer the products of the particle accelerator at the center," he says. For example, Hester feels that a plasma consisting solely of electrons and positrons can account for the Crab's behavior, whereas Arons thinks that an underlying wind of charged atomic nuclei—mainly hydrogen and helium—plays a key role.

Settling such debates will take long hours of scrutinizing the rich images. "There is so much detail," says Chandra project scientist Martin Weisskopf of NASA's Marshall Space Flight Center in Huntsville, Alabama. "We all want to know how this pulsar converts its rotational energy into electromagnetic radiation with such amazing efficiency. It's a fascinating puzzle."

–ROBERT IRION

PHYSICS

CERN Team Produces Antimatter in Bulk

They're still a long way from powering the antimatter drive of Captain Kirk's *Enterprise*, but researchers are generating surprising quantities of antihydrogen. Scientists at CERN, the European laboratory for particle physics near Geneva, report in this week's issue of *Nature* that they have produced about 50,000 slow-moving atoms of antihydrogen, the antimatter doppelgänger of the most abundant element in the universe. Because such atoms are very cold and slow moving, the team hopes it will be able to study them long enough to probe the fundamental asymmetries between matter and antimatter.

"Previous attempts have used accelerators to make [antihydrogen] at high energy, so the atoms have flown away and annihilated," says CERN physicist Jeffrey Hangst. He and his colleagues on the ATHENA collaboration at CERN, however, used a series of magnetic traps to slow down antiprotons and antielectrons from thousands of kelvin to about 15