could leave each party with 50 seats. If that happens, Democrats may demand to fill a number of committee leadership slots, although such power-sharing is unprecedented. With the statewide race likely to remain unsettled until late November, "it's getting agonizing just trying to figure out all the possible scenarios," says one science lobbyist.

Legislators planned to return to Washington this week to try to finish off several spending bills for the current fiscal year—including funding for NIH—that were left hanging after protracted negotiations with the White House broke down a few weeks before the election. But the budget talks have now been pushed back until early December, and the uncertainty over the presidential results makes it impossible to predict how those negotiations will turn out and when Congress will adjourn.

Meanwhile, voters in five states—Arizona, Arkansas, Montana, Oklahoma, and Utah—approved ballot items that will allow officials to begin spending billions of dollars won in state lawsuits against tobacco companies. Although all call for spending some of the money on health care and antismoking efforts, only Arkansas's specifically mentions research, with about $60 million slated for several state-funded universities.

–**DAVID MALAKOFF**

With reporting by Gretchen Vogel.

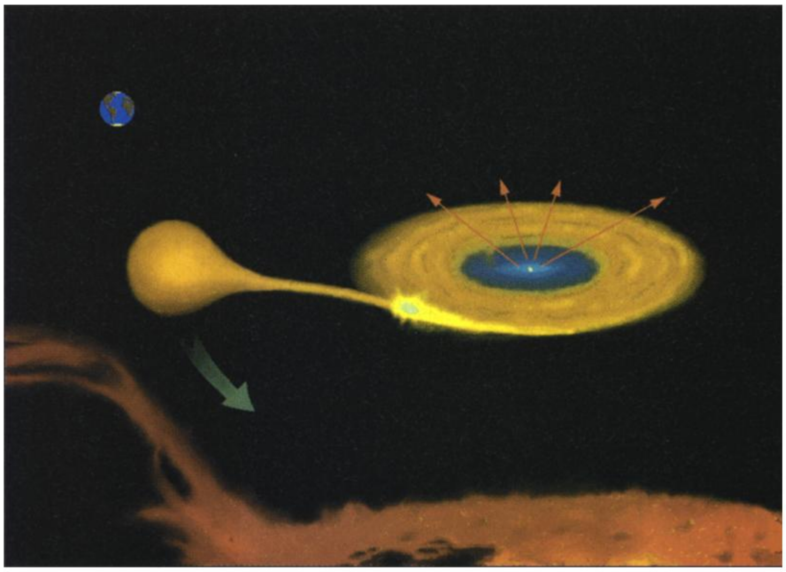
ASTROPHYSICS

# Astronomers Spot Their First Carbon Bomb

**HONOLULU**—Astronomers love watching things blow up, but they've never seen a blast quite like the one described here last week. Carbon on the surface of an ultradense star detonated in a 3-hour thermonuclear explosion, according to a report at a meeting of the American Astronomical Society's High Energy Astrophysics Division. If confirmed, the burst would be the first known cosmic explosion fueled solely by carbon rather than hydrogen or helium. That prospect, says theorist Lars Bildsten of the University of California, Santa Barbara, is "very exciting from a nuclear physics standpoint" for its potential to verify or revise models of carbon combustion.

The blast came from a waltzing pair of stars called a "low-mass x-ray binary." In such a system, a dwarf star orbits closely around a neutron star, a stellar corpse that packs the mass of one or two suns into a dense ball just 20 kilometers wide. Gas from the dwarf flows into a hot spiraling disk around the neutron star. Some gas hits the star's surface, forming a compressed slurry of hydrogen, helium, and a few heavier elements. When pressures and temperatures get high enough within the thickening layer, the elements can flash-fuse in a thermonuclear explosion. Then, the layer rebuilds and the flash repeats after some interval, usually hours or days. This process continues indefinitely, although the timing changes drastically depending on the orbital dynamics of the two stars.

Satellites see most explosions from such systems as mild x-ray flares that last 10 or 20 seconds. Last year, however, astronomers detected four flares that broke the mold. First, researchers at the Space Research Organization Netherlands (SRON) in Utrecht used the Dutch-Italian BeppoSAX satellite to find evidence for a long burst from each of three known low-mass x-ray binaries. The events lasted 500 times longer and unleashed 500 to 1000 times more energy than the generic short pops. "It's a new class of events that will challenge the theorists," says SRON astronomer John Heise. Heise's colleague Erik Kuulkers, however, stops short of claiming that the explosions are carbon-based. The hydrogen-rich dwarf stars in those binary systems don't dump the necessary raw ingredients onto their neutron star companions, Kuulkers believes.



**Carbon ka-boom!** A layer of carbon may have ignited a thermonuclear blast on the surface of this neutron star (center of blue disk). The dwarf companion is a few times larger than Earth, while the entire binary would fit within our sun (bottom of illustration).

CREDIT: NASA GSFC/DANY PAGE, NATIONAL AUTONOMOUS UNIVERSITY OF MEXICO

That's not the case with a fourth long burst, found by Tod Strohmayer of NASA's Goddard Space Flight Center in Greenbelt, Maryland. On 9 September 1999, NASA's Rossi X-ray Timing Explorer (RXTE) satellite picked up a powerful flare from 4U 1820-30, the tightest known low-mass x-ray binary. The two stars whirl around each other once every 11 minutes within a volume of space just slightly larger than the planet Jupiter. The white dwarf feeds nearly pure helium to the neutron star, as its hydrogen gas was stripped long ago.

That helium slowly builds the bomb, Strohmayer says. The helium layer grows 20 or 30 meters thick before it explodes, a process that can happen a few times a day at 4U 1820-30. Each blast leaves some carbon, one of the main ashes of helium fusion. Those ashes, in turn, mantle the neutron star with several hundred meters of carbon after about a year, according to Strohmayer's scenario. When the base of the layer reaches some critical temperature threshold, it ignites a carbon bomb that rages for hours.

"This thing is 1000 times more powerful than the helium bursts," Strohmayer says. "It may blow apart the entire accretion disk." If that's the case, astronomers might gain their best insight yet into how disks of hot gas behave when they spiral into compact stellar remnants. New material from the frantically orbiting white dwarf would quickly replenish the blown-apart disk, Strohmayer says. RXTE's data may contain x-rays flowing from the disk during that reassembly, exposing the physics of the process as never before.

Even more tantalizing to theorists is their first close look at the details of a real carbon detonation, rather than one based on computer codes. Already, there are hints that prior theoretical calculations don't quite align with the stars. Recent work by Bildsten and former student Edward Brown, now a Fermi Fellow at the University of Chicago, suggests that temperatures within the rind of a neutron star should fall well short of the billion degrees or so needed to ignite a relatively thin layer of carbon. A much thicker layer—and the resulting higher pressures at its base—might suffice to trigger the bomb. However, Brown notes, the rates of matter transfer in 4U 1820-30 imply that such a layer would require a century to accumulate. That would make Strohmayer's observation lucky indeed.

Even so, Bildsten and Brown concur that the likeliest explanation is a carbon blast. As for reconciling the theoretical and observational differences, Bildsten says, "it's a fun problem for us to ponder."

–**ROBERT IRION**