struments but within reach, he thinks, of STJs operating in the ultraviolet range, where their spectral resolution should peak.

Caltech's Kulkarni, who is collaborating with the Yale group, has a different application in mind. As one of the world's premier hunters of pulsars—neutron stars that give off regular pulses of radio waves—he is eager to study these objects in optical wavelengths, where their signals are exceedingly faint. He hopes to have an STJ detector mounted on the 10-meter Keck Telescope in Hawaii within 2 years, and he has urged NASA to launch a "crash program" on STJs.

His colleague, Caltech astrophysicist Chris Martin, is already pondering other applications for STJs, such as examining the dim haze of background light from distant galaxies and other objects that pervade the night sky. "We could survey a big chunk of the sky and get spectral information about every object in the picture," Martin says.

Even so, STJ enthusiasts say the devices will probably be restricted to specialized niches in astronomy for some time, leaving most of the optical field to large CCD arrays. "CCDs are so cheap and reliable, it's going to be hard to knock them off their pedestal," Perryman concedes. Jakobsen—the former skeptic now turned STJ champion—agrees. "We're just adding another tool to the tool chest," he says. "Skepticism about STJs still persists, but there's a lot of excitement too."

–Steve Nadis

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ASTROPHYSICS

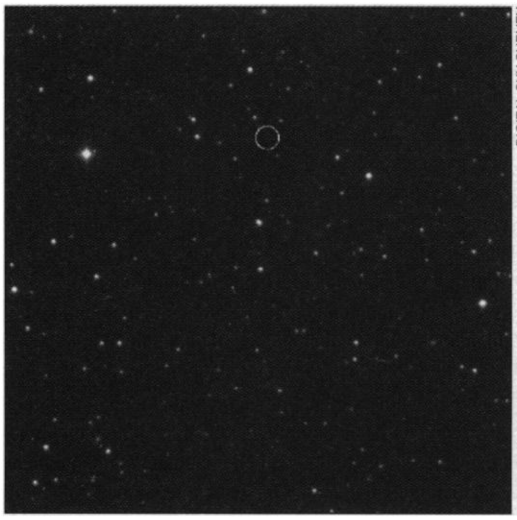
Search Narrows for Gamma-Ray Bursts

For more than 30 years, astronomers have been unable to explain the source of the mysterious bursts of gamma rays that occur approximately once a day in random positions across the sky. Gamma-ray cameras can't pin down the direction of a burst to less than a few degrees. As a result, astronomers haven't been able to link any burst to any known object, or even learn whether these explosive events occur in the neighborhood of our own galaxy or in the far reaches of the universe. But now a simultaneous sighting by an x-ray and a gamma-ray camera on board the Italian-Dutch Beppo-SAX satellite has narrowed the search.

Because x-ray cameras have much sharper angular resolution than do gamma-ray detectors, the 20 July double sighting pinned down the position of the burst to within arc minutes—a precision tens of times greater than before. Astronomers are now scouring the tiny patch of sky, hoping to find an optical or radio "counterpart." No definite candidate has yet been found, but astronomers hope that the double sighting, announced earlier this month in a circular of the International Astronomical Union (IAUC 6467) and described last week at the 82nd National Congress of the Italian Physical Society, will be the first of many that could finally crack the gamma-ray burst mystery.

What made the double sighting possible was the diverse instrument array aboard Beppo-SAX, which was launched last April and is named after Italian x-ray astronomer Giuseppe (Beppo) Occhialini. In addition to a gamma-ray detector, Beppo-SAX also carries an arsenal of x-ray detectors, including two wide-field cameras built by the Utrecht laboratory of the Space Research Organization Netherlands (SRON). On 20 July, one of these cameras happened to be looking in the right direction at the moment the gamma-ray burst occurred and saw a simultaneous burst of x-rays. The positional sensitivity of the x-ray camera enabled astronomers to trace the origin of the burst to a small part of the sky in the constellation Hercules, with a radius of only 10 arc minutes, much smaller than the apparent size of the full moon.

"Small error boxes make the search [for a source] much more meaningful," says University of Chicago astronomer Cole Miller. Astronomers promptly took up the hunt. The Beppo-SAX investigators themselves consulted catalogs of optical sources—stars and galaxies—but were unable to find a suspect counterpart within the error box. Early this month, the Beppo-SAX team enlisted the help of Dale Frail of the National Radio Astronomy Observatory in Socorro, New Mexico, and Shrivinas Kulkarni of the California Institute of Technology in Pasadena to observe the burst area with the NRAO's Very Large Array radio telescope in search of possible radio emissions from the debris of the explosive event. But once again the astronomers found nothing unusual, although "there are plenty of theories which predict a long-lasting radio counterpart after the burst," according to Frail.



DIGITAL SKY SURVEY

Mystery spot. Somewhere in this 15-by-15 arc-minute part of the sky is the source of the gamma-ray burst of 20 July. White circle marks position of x-ray source found by the Rosat satellite.

Thomas Boller and Wolfgang Voges of the Max Planck Institute for Extraterrestrial Physics in Munich, Germany, did find a weak x-ray point source within the SAX error box in 1993 observations by the German Rosat satellite, but Boller and Voges are not sure it has any connection to the gamma-ray burst. In the meantime, their colleague Jochen Greiner has used the high-resolution imager of Rosat to scrutinize the SAX error in detail, and other researchers are making similar observations with x-ray instruments on board the Japanese ASCA satellite and on Beppo-SAX. Results have not yet been disclosed.

SRON's John Heise, project scientist for the x-ray wide-field cameras on Beppo-SAX, believes that the satellite should be able to make such double detections as often as six times per year. Next time, astronomers looking for a counterpart could get lucky, says Jan van Paradijs of the University of Amsterdam in the Netherlands, "especially if the position could be passed on to radio and optical observers much more quickly."

Some astronomers doubt that observations such as those by Beppo-SAX will be accurate enough, however. Princeton University's Bohdan Paczyński says finding counterparts "will not be possible until the error boxes become much smaller still. There are lots of different objects even in a 1-by-1 arc minute part of the sky." That problem may be solved by the High-Energy Transient Experiment (HETE), a small international satellite that is due for launch by NASA in the next few weeks. HETE carries not only gamma-ray and x-ray detectors, but also four sensitive ultraviolet cameras, which can locate sources with even greater precision.

If gamma-ray bursts are accompanied by ultraviolet emission, HETE will be able to pinpoint their locations to within a couple of arc seconds. But if an even more focused hunt still doesn't yield a counterpart, the mystery of gamma-ray bursts will become that much deeper.

–Govert Schilling

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