or so. "We estimate the ability to reject 97% of the background contribution," says Girard.

Two other groups hope to eliminate spurious signals by exploiting different phase transitions at higher temperatures. Both teams, one in Canada and one a CERN-Lisbon-Paris collaboration, use liquid Freon droplets, a few tens of micrometers in diameter, entombed in a clear polymer gel. At room temperature, above Freon's boiling point, the droplets are confined in an unstable superheated state. If an impacting WIMP deposits enough energy in a Freon droplet, "there is a sudden phase transition during which the droplet is vaporized and expands into a bubble of Freon gas of about 1 millimeter in diameter, which is contained at its location in the polymer," says Viktor Zacek of the University of Montreal, spokesperson for the Canadian group. The result, says Juan Collar of CERN, a member of the competing team, "is a characteristic audible sound emission that can be picked up when this happens."

Such detectors "are totally insensitive to low-energy photons, the main source of background in dark-matter searches," Collar adds. Most background radiation does not deposit enough energy in a sufficiently short distance for the superheated bubbles to notice. "So life is much easier for the WIMP hunter," says Collar. Last month, the Canadian team started running a prototype system based on just a few grams of Freon droplets. Larger systems are in the pipeline, to be installed in the Creighton mine in Ontario. The European team, says Collar, plans to install its prototype in a shallow tunnel near Paris this year.

In spite of all the impressive technology being deployed, there remains the possibility that all these searches may draw a blank. WIMPs could simply be a fix conjured up by astronomers and cosmologists to get their theories to match what they see in the universe around them. But Sadoulet says the history of physics shows that what appears at the time to be a "fix" can later look like prescience. He points to the difficulties faced by Neils Bohr and his contemporaries in the early 1930s as they struggled to understand radioactive beta decay, in which some energy seemed to simply vanish. Bohr proposed dumping the principle of energy conservation, while Wolfgang Pauli proposed that the energy was fleeing in the form of a ghostly new particle, purely hypothetical at the time—the neutrino. The rest is history.

–Andrew Watson

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ASTRONOMY

Gamma-Ray Source in Distant Universe?

Discovering where a crime was committed isn't the same as solving it. But it's a good start, especially when one possible crime scene is just around the corner and the other is at unimaginably large distances. The crime, in this case, is a celestial act of violence called a gamma-ray burst—a bright flash of extremely energetic radiation from a mysterious source, at a random position in the sky. Just hours after astronomers had narrowed down the position of one burst, Jan van Paradijs of the University of Amsterdam and the University of Alabama, together with Paul Groot and Titus Galama of Amsterdam, pointed a telescope at the site and spotted what may be the source: a dim galaxy in the far reaches of the universe.

Scoping out a burst. The William Herschel telescope.

"The key to [finding burst sources] is to observe the suspect region with a large optical telescope within 24 hours after the event," says van Paradijs. If he and his colleagues really have pinpointed a burst source, they will have taken a major step toward solving a decades-old mystery. Over the last 30 years, space-based detectors have picked up hundreds of these gamma-ray flashes, but astronomers disagree about what might be producing them and even where they come from. According to the "local" hypothesis, violent events on neutron stars—the dense relics of massive stars—in the neighborhood of our own galaxy are responsible. The competing "cosmological" hypothesis holds instead that gamma-ray bursts are even more violent events in distant galaxies.

Neither view could prevail because the poor directional resolution of gamma-ray detectors kept astronomers from linking the bursts to any identifiable objects. That may have changed, thanks to a series of observations beginning 28 February, when the Italian-Dutch satellite Beppo-SAX detected a burst and then spotted a source of x-rays at the burst position. The x-ray observation enabled astronomers to pinpoint the event to a patch of sky less than an arc minute across—about a thirtieth of the width of the full moon (*Science*, 14 March, p. 1560).

Only 21 hours after the burst, van Paradijs and his colleagues made an image of the stars and galaxies in this tiny patch of sky with the William Herschel and Isaac Newton telescopes at the Roque de los Muchachos Observatory on the Canary Islands. Eight days later, they made a second image—and found that one point of light in the field had faded. On 13 March, Griet van der Steene of the European Southern Observatory took a close look at the object, by then very faint, with ESO's 3.5-meter New Technology Telescope at La Silla, Chile, and discerned a small, dim galaxy.

Van Paradijs and his colleagues, who announced their discovery late last week in a circular of the International Astronomical Union, argue that "the position and rapid decline [of the galaxy] contemporaneous with that of the Beppo-SAX x-ray transient indicate that the two are related." Whether the x-ray source really corresponded to the original gamma-ray burst is a bit less certain, says van Paradijs, but the link "smells good." That would spell the death of the local hypothesis, he adds, noting that he himself has favored that view in the past. Cambridge University astronomer Martin Rees agrees that the Dutch observations "strongly tilt the balance in favor of the cosmological hypothesis," although he adds that it would take several more observations of the same kind to settle the question.

The burden would then be on theorists to explain what could produce a flash of gamma rays so powerful that it can be seen from the far reaches of the universe. Many believe that only the collision of two neutron stars could do the job. Neutron stars orbiting each other lose energy by emitting gravitational waves and gradually spiral together. This fatal attraction inevitably leads to the death of both, in a terrible *crime passionelle double*.

But as to how the energy of the cataclysm could be turned into gamma rays, "there are hardly any serious theories," says Frank Verbunt, an x-ray and high-energy astrophysicist at the University of Utrecht in the Netherlands. It will take more efforts like this one, combining gamma-ray, x-ray, and optical observations, to produce a full picture of the crime.

Such efforts may be hampered, however, by an ailing Beppo-SAX. Two of the six gyroscopes that stabilize the satellite have failed, one in December and one in January, and a third is faltering. Officials at the Italian Space Agency (ASI) are playing down the problem, insisting that they can control the satellite by other methods if more gyros fail. "It's no big deal. ... The mission could even continue without the gyroscope system," a senior ASI scientist told *Science*.

–Govert Schilling, with reporting by Susan Biggin

Schilling and Biggin are writers in the Netherlands and Italy, respectively.