

the transition temperature generally increases as the number of copper oxide layers in the compounds' crystal units ratchets up from one to two to three. Members of the new mercury family having more than one copper oxide layer, it seemed, might have higher transition temperatures, too.

The ETH group took the hint. Their record-beater sports a pair of related compounds with two and three copper oxide layers, respectively. Last week, when preprints of the ETH paper began circulating, researchers in many labs including ones at Argonne National Laboratory and the Texas Center

for Superconductivity at the University of Houston (TcSUH) began the key ritual of trying to replicate the results and make similar compounds that might even have higher transition temperatures. By press time, Paul C. W. Chu, director of TcSUH, told *Science* his group had reproduced the ETH results. And rumors of 144 K materials were already circulating, notes Ellen Feinberg, editor of *High Tc Update*, a newsletter published by the Ames Laboratory at Iowa State University.

But HTS researchers, having been through similar research frenzies before, have learned to cool their optimism. "It is always exciting

when a promising new material comes around," says Chu. But he and others caution that there are plenty of unknowns, among them the stability of this new class of mercury-based compounds and the amount of electrical current they can carry, both of which are critical criteria for practical superconductors. Moreover, mercury, like thallium and bismuth, packs some toxic might.

In spite of these potential pitfalls, the presence of mercury in this benchmark compound may be a good omen for the field. Mercury, after all, is the Roman god of Commerce.

—Ivan Amato

ASTRONOMY

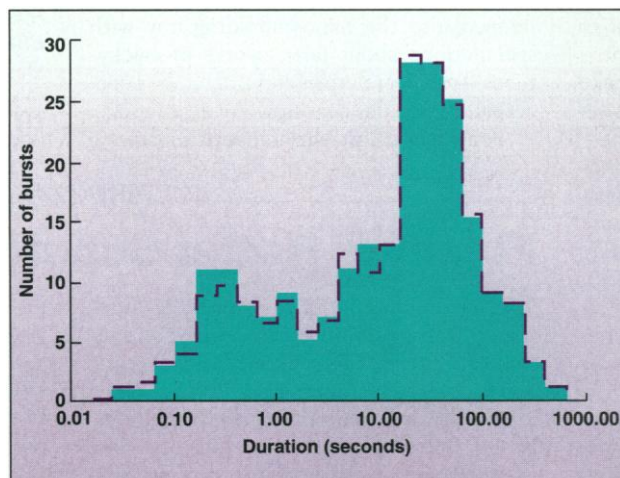
A Double Dose of Gamma-Ray Bursts

Few astronomical mysteries have been as unyielding as the powerful flashes of gamma rays that erupt about once a day from random directions in the sky. After 20 years of cataloging these gamma-ray bursts, astronomers still have not been able to link any one of them to a known object—a star, quasar, or galaxy—make any sense of their distribution around the sky, or find other clues to their nature. Even the latest results from National Aeronautics and Space Administration's orbiting Gamma Ray Observatory (GRO), which triggered a flurry of press attention last month, showed no break in the uniform distribution of bursts around the sky. But a less publicized analysis of GRO data is finally yielding hints of a pattern in these puzzling events.

The analysis, by investigators working with the Burst and Transient Source Experiment (BATSE) aboard GRO, suggests that there may actually be two different classes of events: one made up of bursts lasting just fractions of a second and the other of bursts that go on for tens to hundreds of seconds. Theorists pondering the origin of the bursts don't know what to make of the finding. But they are hailing it as a potential clue—one that is all the more tantalizing because another analysis based on different criteria, by Donald Lamb of the University of Chicago, also hints at two classes of bursts. "This has profound implications for future models" of these events, says Princeton theorist Bohdan Paczynski.

For Paczynski, the result, while welcome, is something of an embarrassment, because he and fellow theorists had overlooked earlier hints of the pattern. The first came in data from a detector flying aboard the Pioneer Venus Orbiter in 1990. Then, in 1991, a French-Soviet group presented a more complete analysis of data from the Soviet satellite GRANAT, which not only pointed to distinct classes of

long and short bursts, but also showed that the shorter ones shot out a higher proportion of energetic "hard" gamma rays than the longer ones. But back then, says Paczynski, there were all kinds of claims about gamma-ray bursts, and he didn't think these experiments had



Doubling up. Two classes of gamma-ray bursts stand out in both raw (green) and corrected (dashed line) data.

enough data to prove their case. "Somehow I had so little confidence in other experiments that I was blind," says Paczynski. "Now I see there was evidence everywhere."

What finally convinced him was the announcement by Chryssa Kouveliotou of the Universities Space Research Association, based in Columbia, Maryland, and her colleagues on the BATSE team that they found a similar pattern when they analyzed 200 of the 600 bursts recorded by GRO since its launch 2 years ago. The BATSE group, which announced the finding in an electronic mail bulletin in February and has submitted a paper to the *Astrophysical Journal*, also notes that although events in the two classes differ in average duration by factors of 100 or so, their peak brightness is always about the same. That consistency impresses theorist Paczynski. "This tells us something very important,"

he says, though he is quick to admit he doesn't know exactly what that is.

Indeed, it seems that with gamma-ray bursts, nothing is ever straightforward. While the BATSE group sees one kind of division, Lamb sees a somewhat different one. Lamb analyzed the same set of bursts but classified them by their variability—the degree to which they flickered—instead of their duration. He found that the bursts fell into two classes, "smooth" and "rough." On further analysis, he discovered that his two classes also exhibited striking differences in a number of other properties, including brightness, duration, and spectrum.

At bottom, the two analyses may have uncovered the same thing, says Harvard University theorist Ramesh Narayan. "What Lamb calls variable is the same as what the BATSE group calls long," he says. Lamb concedes that there may be some overlap, but he thinks his classification scheme is more valuable, because his two sets of bursts differ in many other characteristics besides duration. Kouveliotou and colleagues argue that Lamb's results arose from misleading systematic effects—not a real physical distinction.

The confusion may be dispelled once both groups' methods and conclusions are published (Lamb has also submitted his findings for publication, in *Astrophysical Journal Letters*). Then theorists can start applying the findings to try and narrow the field of theories explaining the bursts. There are now no less than 117 different explanations, by Paczynski's count. Some place the sources around the galaxy, others say they lie at the very edge of the universe, and each gives a different scenario for the energy release, often invoking some kind of detonation or collision of a neutron star or black hole. "How do you believe any of them?" asks Paczynski. With so many models and so few data, he and his colleagues are hoping this clue will be just the first of many.

—Faye Flam