X-Ray Source With a Quasi Beat

Bright celestial X-ray sources tend to be binary star systems. Astrophysicists tend to believe that one member of such binaries is a neutron star. In the cases of the X-ray sources found in the "galactic bulge," the fat central region of our galaxy, researchers find reason to believe that such neutron stars should be "spun up" by the dynamics of the binary system until they are rotating from hundreds to a thousand times a second. Such neutron stars could emit X-ray pulses with a precisely even period, timed according to their rotation. Now, a mostly European group looking for such pulsations in the X-ray source GX5-1 has found instead "quasiperiodic emissions," chains of pulses with varying periods. This seems to make GX5-1 the first example of a newly discovered class of celestial objects, which the discoverers of the pulsations call "quasiperiodic objects," or QPOs.

The observers used the European Space Agency's EXOSAT satellite. The story proves the adage: If at first you don't succeed, try at least once again. Searches of data taken by various pieces of X-ray observing equipment had failed to find any fast periodic pulsations in galactic bulge sources. Astronomers thought that if there were any such things, EXOSAT, which is a particularly sensitive X-ray detector, should find them, but even a 1983 search with EXOSAT failed to turn up evidence of periodic pulses. However, the present observing group decided that a second try was warranted. They got authorization to do this and made their observations in September 1984.

Analysis of the data seemed at first disappointing, as the sought-for precise periodicity did not appear. However, a closer look brought out the evidence for the quasiperiodic pulses, trains of pulses with periods ranging from 20 to 40 oscillations per second. The results were reported in the July 18 NATURE by Michiel van der Klis of the European Space Agency's Space Science Department in Noordwijk, the Netherlands; F. Jansen of the Laboratory for Space Research in Leiden, the Netherlands; J. van Paradijs and E.P.J. van den Heuvel of the University of Amsterdam; Walter H.G. Lewin of Massachusetts Institute of Technology; and J.E. Trümper and M. Sztajno of the Max Planck Institute for Extraterrestrial Physics in Garching, West Germany.

The discovery has reportedly caused great excitement in the X-ray astronomical community. As the news has spread, quasiperiodic pulsations have also been reported in two long-known X-ray sources, Scorpio X-1 and Cygnus X-2. The GX5-1 group took a second look on April 29, 1985, and again found the quasiperiodic oscillations in that object.

A number of theoretical suggestions to explain the quasiperiodic pulsations have already been put forth. The one most favored by the GX5-1 observing group comes from M. Ali Alpar of the University of Illinois at Urbana and Jacob Shaham of Columbia University in New York City. This theory proposes that the quasiperiodic pulses represent a "beat" frequency, a combination of the precise rotations of the neutron star with the variable rotations of an accretion disk around it.

Astrophysicists' general picture of these binary X-ray sources is that of a neutron star gravitationally bound to a more ordinary star. The strong gravity of the neutron star pulls material from the companion. Because of the rotations and orbital motion of the system, this material does not fall directly onto the neutron star but forms an accretion disk around it. The accretion disk is tied to the neutron star's magnetic field and rotates with it. Matter moves gradually through the disk before falling on the neutron star.

What Alpar and Shaham propose is that material on the inside edge of the accretion disk is perturbed by the strength of the neutron star's magnetic field and breaks into clumps. The formation and rotation of these clumps is irregular, depending on the infalling material's flow rate, which changes from time to time. The quasiperiodic pulsations would then be a combination of the neutron star's precise rotation (which is hidden from observation from earth) and the clumps' irregular rotations.

The GX5-1 observers say that from this theory one can calculate that the neutron star's rotation period is about 10.5 milliseconds, or about 100 rotations per second, and that the lifetimes of the blobs vary between 0.1 and 0.2 second.

— D.E. Thomsen

Monday turns a lighter shade of blue

Blues guitarist "T-Bone" Walker may have had a point when he crooned, "They call it stormy Monday, but Tuesday's just as bad, Wednesday's worse and Thursday's also sad." State University of New York at Stony Brook psychologists find that middle-income, married men report elevated moods on weekends, while their emotional outlook dips to a steady level from Monday through Thursday.

Holding to the cultural stereotype of Mondays as singularly "blue," the men thought their mood was lowest on Mondays, although daily self-reports of mood did not support their general belief, note the researchers in the July JOURNAL OF PERSONALITY AND SOCIAL PSYCHOLOGY.

"This was an odd finding that popped out during a larger study of mood, stress and physical illness," says study director Arthur A. Stone.

In two initial studies, a total of 104 married men filled out mood reports for 90 to 112 consecutive days. Each wife reported daily perceptions of her husband's mood. A segment of 42 consecutive days with the most complete data was selected for analysis from each volunteer. The men were mostly white-collar workers around age 42.

The results: Positive mood was substantially higher and negative mood was lower on weekends (Friday, Saturday and Sunday). Mood worsened on Mondays and stayed about the same through Thursdays. Wives' reports corroborated this trend. Twenty-one of the subjects also reported their mood by telephone five times a day for two weeks. Again, Monday mood, even at 9 a.m., was not significantly lower than for any time on other weekdays.

Another 616 middle-class, married men were selected from a larger random sample of adults in eastern Long Island, N.Y. Subjects were mailed questionnaires in which they reported how they felt at the moment. Responses were distributed across different days of the week and showed a similar pattern; measures of depressed mood declined on the weekends and rose to a stable level on Mondays through Thursdays.

Of 57 subjects contacted from the first sample, two-thirds chose Monday as the day with the worst mood. The best mood was attached to Friday, with Sunday and Saturday close behind.

Middle-class, married men are not representative of all Americans, acknowledges Stone, but one would expect them to be prime candidates for "blue Mondays." A preliminary study of college students also finds no mood differences between Mondays and the other weekdays, he adds.

So why does Monday have an undeserved "stormy" reputation? One possibility, says Stone, is that the cultural belief in "blue Monday" colors general perceptions of that day but not daily mood reports over the long run. Also, the drop in mood from Sunday to Monday is the steepest of the week and makes Monday seem worse than other days. *—B. Bower*