Twinkle, Twinkle, X-Ray Source

Everyday astronomy deals with what happened billions of years ago in galaxy NGC something-or-other. It also deals with what happened last night or will happen tonight in dozens of observatories on the face of the earth: Is something breaking somewhere in the sky that merits night by night or week by week monitoring so as not to miss important developments?

One of the objects about which that question was raised this week was the X-ray source GX 339-4, also known as 4U 1658-48. As the second catalog number shows, the object was discovered as an X-ray source by the Uhuru satellite and entered in the fourth catalog prepared from Uhuru data. It was later identified with a visible body.

Observations of this visible body done at the European Southern Observatory (located at Las Campañas, Chile) by C. Motch of ESO and S.A. Ilovaisky and C. Chevalier of the Meudon Observatory in France convinced them that something interesting was afoot there. They sent a short report of their findings to the Central Bureau for Astronomical Telegrams (at the Smithsonian Astrophysical Observatory in Cambridge, Mass.), which then circulated their note to other observatories in one of its periodic circulars.

Work done on the nights of May 28 and 29, particularly, found more or less cyclic fluctuations with a period of about 20 seconds in the object's light (up to 40 percent of the total) and sharp bursts of the order of 20 milliseconds in duration. Furthermore, this body's overall brightness has increased by about 6 magnitudes since March. "Further optical and X-ray observations are urgently needed," the note concludes.

To Bruce Margon of the University of Washington, each of these activities is characteristic of one or another of these classes of X-ray sources, but taken together they may make a single object that might be worth looking at. It's "interesting, but not the revelation we're all sitting waiting for."

The man who two years ago did the optical identification of GX 339-4, Jonathan Grindlay of the Harvard-Smithsonian Center for Astrophysics, is particularly interested in the millisecond light bursts. ("I regret I didn't send in my own card," he says. He has data taken at Cerro Tololo Inter-American Observatory a few days before the French group observed that show some of the same things.) The millisecond light bursts seem to parallel X-ray bursts of similar duration reported two years ago, and they support a model of the object that sees it as a binary star system with one member very condensed. The condensed body has strong gravity and draws matter from its companion. As it falls on the condensed body, this matter forms a so-called accretion disc around it. X-rays are generated as the infalling matter hits the condensed star. On their way out the X-rays heat the disc and cause it to glow in visible light. In this model most of the light comes from the disc, not the two stars.

"More will watch," Grindlay says. The only X-ray satellite now up is the Japanese one. The Japanese will probably be able to follow it, the CTIO and ESO people will monitor it, he says.

To a theoretician, William Rhodes of the University of Maryland, the thing is well worth going out to take a look at. He is particularly interested in the large, quick changes in brightness. He suggests they may mean something is about to happen. Astronomers would hate to miss a nova or a supernova on the way up, but nobody knows just what the precursors are. There is also the chance of spending lots of precious telescope time on an object that just sputters along forever and never blasts off. Questions like that plus the bright desert sun must give many an astronomer sleepless days. □

Astronomical observations from afar

Although most of its objects of study are far beyond human reach, astronomy is nevertheless a very "hands-on" kind of science. Telescopes and attached instruments are adjusted by human fingers, coaxed by human fingers, banged by human fists, and subject to gestures of benediction or malediction made by human hands. However much they may complain of freezing cold telescope domes, astronomers, more than other physical scientists, have wanted to be present at their own observations.

Now they are beginning to do it by remote control. Kitt Peak National Observatory has just finished a five-night trial of what they say is the most extensive test of remote astronomical observing yet attempted. Astronomer Robert Kirshner was able to sit in his office at the University of Michigan in Ann Arbor and direct the pointing of a telescope and control data-taking equipment on Kitt Peak in southern Arizona. Everyone concerned thinks this is the beginning of a trend.

The reasons are budgetary and psychological. The first is the cost of travel and maintaining astronomers during their stay on the observatory mountain. On Kitt Peak, for instance, every drop of water is captured rain run-off and must be doled out carefully. The cost of trucking food and other supplies to the mountaintop is high. "They're maintaining a modest hotel on top of the mountain," Kirshner says.

And astronomers don't really appreciate it. They complain of boredom. (Some just observe, eat and sleep.) They miss their families, friends, and usual social occasions. And they have to interrupt their teaching and other university responsibilities. Kirshner mentions also the time lost in travel and psychophysical wear and tear.

Kirshner's routine for the five nights of observation (June 4 to 9) was to go to his office at midnight. There was the terminal of the data hook-up to Kitt Peak. The hook-up gave him an open voice line to the telescope operator at Kitt Peak, control of the data-taking equipment and a TV screen that showed him (not exactly in real time) what the telescope saw.

Both Kirshner and Kitt Peak spokesman Gary Mechler say that giving the remote observer actual control of the telescope's motions is superfluous. Even if the astronomer is in the dome, the operator does the actual moving of the telescope according to vocal instructions. Kirshner's TV screen gave him a picture of what the telescope saw that changed every 30 seconds. This was enough, he says, to enable him to decide what to watch and for how long.

One of the questions in efficient allocation of telescope time is how long to watch each object on the program. If the program is simply telexed to the telescope operator, he, being conscientious, will tend to look too long at most objects, and yet may not be able to appreciate significant developments in one or two that merit a still longer look.

Kirshner says this form of interactive control is more efficient. The work involved is a study of redshifts of a large number of galaxies being done by many observers throughout the world. This requires recording the spectrum of each galaxy in turn. With the interactive system, says Kirshner, "I can look at each spectrum and say 'enough, on to the next.'" The project requires hundreds of redshifts by all the astronomers involved. On June 8 Kirshner told SCIENCE NEWS he was getting between 6 and 10 a night.

Observations ended at 7:00 a.m. EST each day. Kirshner then went home and slept a few hours. Later in the day he would return to the office to tend to his university responsibilities.

The data were transmitted over ordinary telephone lines. Someday it is hoped there will be a satellite link. Then it may be possible to use the system for really remote observatories like Cerro Tololo and the European Southern Observatory. □