



1
00:00:00,020 --> 00:00:11,050

Music

2
00:00:11,070 --> 00:00:15,110

High-mass binary systems are studies in extremes. They pair a hot,

3
00:00:15,130 --> 00:00:19,180

massive star with a compact remnant--like a white dwarf, a neutron star

4
00:00:19,200 --> 00:00:23,240

or even a black hole. And they produce lots of x-rays.

5
00:00:23,260 --> 00:00:27,260

But only a few of these systems are known to emit gamma rays, the most

6
00:00:27,280 --> 00:00:31,330

energetic form of light. And only in one of them do scientists know the precise

7
00:00:31,350 --> 00:00:35,350

nature of the compact object. It's a pulsar, a neutron star

8
00:00:35,370 --> 00:00:39,410

roughly the size of Washington D.C., that spins about 21 times a second.

9
00:00:39,430 --> 00:00:43,440

Each rotation sweeps a beam of radio emission toward Earth.

10
00:00:43,460 --> 00:00:47,490

Every few years, the system gets really interesting.

11
00:00:47,510 --> 00:00:51,530

That's when the pulsar's orbit carries close to its massive companion star,

12
00:00:51,550 --> 00:00:55,550

which is surrounded by a disk of gas. As it swings

13
00:00:55,570 --> 00:00:59,590

around its companion, the pulsar twice grazes this disk producing

14

00:00:59,610 --> 00:01:03,630

gamma rays each time. In late 2010

15

00:01:03,650 --> 00:01:07,690

NASA's Fermi Gamma-ray Space Telescope watched the system glow with faint gamma

16

00:01:07,710 --> 00:01:11,740

emission as the pulsar first approached the disk.

17

00:01:11,760 --> 00:01:15,770

Astronomers expected the same behavior in early 2011 when the outbound pulsar

18

00:01:15,790 --> 00:01:19,810

grazed the disk again, but that's not what happened.

19

00:01:19,830 --> 00:01:23,840

Instead, Fermi detected intense and puzzling gamma-ray flares.

20

00:01:23,860 --> 00:01:27,880

The system produced more emission on some days during the second pass than it did throughout

21

00:01:27,900 --> 00:01:31,910

the entire first pass. Yet telescopes observing at

22

00:01:31,930 --> 00:01:35,940

radio and X-ray wavelengths saw nothing unusual.

23

00:01:35,960 --> 00:01:39,980

It's a mystery astronomers are working to solve. But, frustratingly, the pulsar is now heading

24

00:01:40,000 --> 00:01:44,030

toward the farthest part of its orbit. Better

25

00:01:44,050 --> 00:01:48,070

understanding this unique system will help scientists work out the natures of the compact objects

26

00:01:48,090 --> 00:01:52,110

in other high-mass binaries. Scientists will also use the data they've

27

00:01:52,130 --> 00:01:57,180

collected to predict what to expect at the pulsar's next close encounter, in 2014.