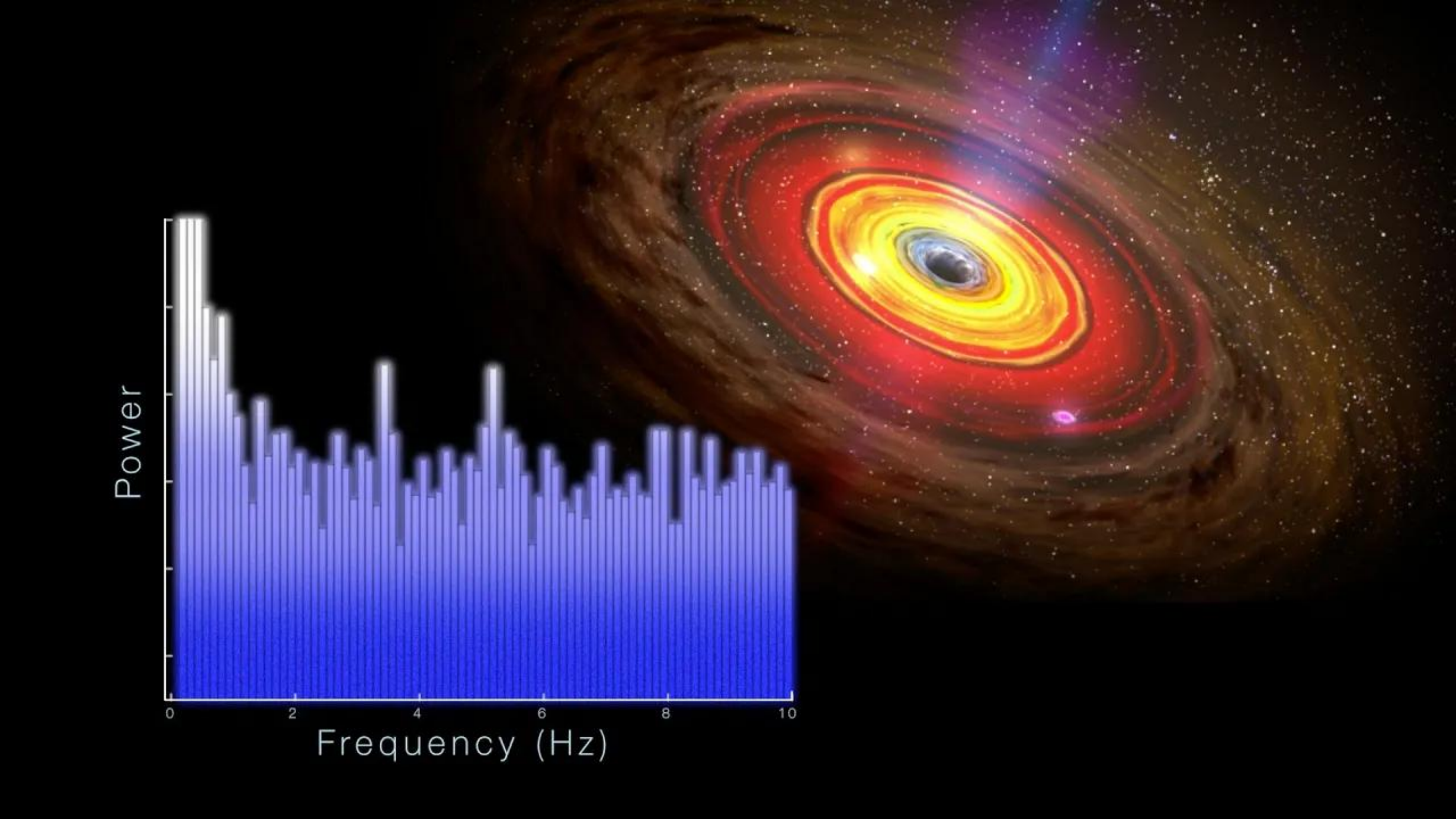
Power
0
2
4
6
8
10
Frequency (Hz)

1
00:00:08,120 --> 00:00:04,070
[Music]

2
00:00:08,140 --> 00:00:12,130
Using archival data from NASA's decommissioned

3
00:00:12,150 --> 00:00:16,180
RXTE X-ray satellite, researchers have discovered a rare

4
00:00:16,200 --> 00:00:20,220
type of black hole lurking in M82, a galaxy about

5
00:00:20,240 --> 00:00:24,260
12 million light-years away. Known as M82 X-1,

6
00:00:24,280 --> 00:00:28,290
the object is the galaxy's brightest X-ray source.

7
00:00:28,310 --> 00:00:32,340
It was long suspected of being an exceptional midsize black hole, too big to

8
00:00:32,360 --> 00:00:36,380
be made by a dying star, yet much smaller than the monsters found in the hearts of

9
00:00:36,400 --> 00:00:40,400
galaxies, but definitive evidence had never materialized.

10
00:00:40,420 --> 00:00:44,460
Now, through careful analysis of RXTE data, astronomers have

11
00:00:44,480 --> 00:00:48,460
shown that M82 X-1 weighs in at about 400 times the mass of

12
00:00:48,480 --> 00:00:52,470
our sun. Measured masses for black holes formed by stars reach

13
00:00:52,490 --> 00:00:56,530

about 25 solar masses, and those found in galaxy centers weigh at least

14
00:00:56,550 --> 00:01:00,570
10,000 times more. Only a handful of black holes have been

15
00:01:00,590 --> 00:01:04,620
discovered with inferred masses between these extremes. Astronomers

16
00:01:04,640 --> 00:01:08,680
measured M82 X-1 by finding a special signature in its X-ray glow.

17
00:01:08,700 --> 00:01:12,720
Hot gas orbiting a black hole emits X-rays.

18
00:01:12,740 --> 00:01:16,730
Near the bring of the black hole, various physical effects create hot spots, which

19
00:01:16,750 --> 00:01:20,790
produce variations as they orbit. These signals encode

20
00:01:20,810 --> 00:01:24,840
important clues to the black hole's mass. One important signal comes

21
00:01:24,860 --> 00:01:28,880
in the form of stable pairs with a 3-to-2 relationship, meaning that one

22
00:01:28,900 --> 00:01:32,910
flashes three times for every two flashes of the other. In

23
00:01:32,930 --> 00:01:36,970
searching through six years of RXTE observations of M82 X-1,

24
00:01:36,990 --> 00:01:41,010
astronomers recently found this key signature. One hot spot

25
00:01:41,030 --> 00:01:45,050
flashes 5.1 times a second, while the other flickers 3.3 times a second--

26
00:01:45,070 --> 00:01:49,110
a solid 3-to-2 relationship. These

27
00:01:49,130 --> 00:01:53,160
signals, combined with other previously variations, pointed to an accurate

28
00:01:53,180 --> 00:01:57,210
mass of about 400 suns. With that finding,

29
00:01:57,230 --> 00:02:01,250
M82 X-1 now joins the exclusive club of middle-mass

30
00:02:01,270 --> 00:02:05,300
black holes. [Music]