
NASA
BLACK HOLE
STAR DESTROYER

1
00:00:05,110 --> 00:00:03,189
scientists used supercomputer

2
00:00:08,870 --> 00:00:05,120
simulations to throw eight different

3
00:00:10,950 --> 00:00:08,880
types of stars at a monster black hole

4
00:00:13,430 --> 00:00:10,960
their goal is to create more realistic

5
00:00:16,070 --> 00:00:13,440
models of tidal disruption events which

6
00:00:17,750 --> 00:00:16,080
occur when unlucky stars stray too close

7
00:00:19,910 --> 00:00:17,760
to black holes

8
00:00:22,310 --> 00:00:19,920
gravitational forces create intense

9
00:00:25,029 --> 00:00:22,320
tides that deform the stars and break

10
00:00:26,950 --> 00:00:25,039
them into streams of gas

11
00:00:28,630 --> 00:00:26,960
these simulations are the first to

12
00:00:31,269 --> 00:00:28,640
combine the physical effects of

13
00:00:33,430 --> 00:00:31,279

einstein's general theory of relativity

14
00:00:35,910 --> 00:00:33,440
and virtual stars with realistic

15
00:00:37,750 --> 00:00:35,920
internal structures

16
00:00:39,270 --> 00:00:37,760
this schematic shows the star's

17
00:00:41,270 --> 00:00:39,280
trajectory

18
00:00:43,270 --> 00:00:41,280
in this version of the simulations the

19
00:00:44,549 --> 00:00:43,280
black hole has one million times the

20
00:00:46,869 --> 00:00:44,559
sun's mass

21
00:00:49,190 --> 00:00:46,879
and the stars are about 24 million miles

22
00:00:52,229 --> 00:00:49,200
away at their closest

23
00:00:54,630 --> 00:00:52,239
the model stars range from about 1 10 to

24
00:00:57,029 --> 00:00:54,640
10 times the sun's mass

25
00:00:59,349 --> 00:00:57,039
the colors reflect their densities

26
00:01:06,469 --> 00:00:59,359
from the lowest shown in blue to the

27
00:01:10,710 --> 00:01:09,350
in some cases the stars are fully pulled

28
00:01:13,030 --> 00:01:10,720
apart

29
00:01:15,270 --> 00:01:13,040
in others they're only partially

30
00:01:17,190 --> 00:01:15,280
disrupted

31
00:01:19,670 --> 00:01:17,200
as these stars move farther from the

32
00:01:21,510 --> 00:01:19,680
black hole their own gravity pulls them

33
00:01:24,070 --> 00:01:21,520
back together

34
00:01:26,390 --> 00:01:24,080
surprisingly the stars that fully and

35
00:01:28,070 --> 00:01:26,400
partially disrupt aren't cleanly divided

36
00:01:30,789 --> 00:01:28,080
by mass

37
00:01:35,670 --> 00:01:30,799
the sun-like star along with those with

38
00:01:38,069 --> 00:01:35,680

0.15 0.3 and 0.7 solar masses survive

39
00:01:41,990 --> 00:01:38,079
their close encounters

40
00:01:46,310 --> 00:01:42,000
but stars with 0.4 0.5 3 and 10 times

41
00:01:48,230 --> 00:01:46,320
the sun's mass are completely torn apart

42
00:01:49,429 --> 00:01:48,240
the difference between survival and

43
00:01:54,149 --> 00:01:49,439
destruction

44
00:01:56,069 --> 00:01:54,159
depends on the star's internal density

45
00:01:57,990 --> 00:01:56,079
simulations like these will help

46
00:02:00,310 --> 00:01:58,000
astronomers build a better picture of

47
00:02:02,469 --> 00:02:00,320
these catastrophic events

48
00:02:05,370 --> 00:02:02,479
occurring in galaxies millions of light