TOI 700 d illustration

1
00:00:03,909 --> 00:00:01,589
[Music]

2
00:00:05,670 --> 00:00:03,919
nasa's test mission has found its first

3
00:00:07,269 --> 00:00:05,680
earth-sized world in its star's

4
00:00:10,390 --> 00:00:07,279
habitable zone

5
00:00:12,470 --> 00:00:10,400
this means the planet called toi 700d

6
00:00:14,230 --> 00:00:12,480
has the potential for liquid water on

7
00:00:16,390 --> 00:00:14,240
its surface

8
00:00:18,550 --> 00:00:16,400
test stares at patches of sky for long

9
00:00:19,910 --> 00:00:18,560
stretches recording light from thousands

10
00:00:21,670 --> 00:00:19,920
of stars

11
00:00:24,790 --> 00:00:21,680
some of these stars have planets that

12
00:00:27,029 --> 00:00:24,800
cross or transit in front of them

13
00:00:29,589 --> 00:00:27,039

tess sees these events as tiny regular

14
00:00:32,229 --> 00:00:29,599
dimmings of the host's stars

15
00:00:35,510 --> 00:00:32,239
one star where tess saw transits is toi

16
00:00:37,750 --> 00:00:35,520
700 it's a red dwarf about 40 percent

17
00:00:40,069 --> 00:00:37,760
the mass and size of our sun and roughly

18
00:00:41,750 --> 00:00:40,079
half its temperature

19
00:00:43,750 --> 00:00:41,760
one set of transits announced the

20
00:00:47,029 --> 00:00:43,760
presence of a planet close to the star

21
00:00:48,950 --> 00:00:47,039
called toi 700b

22
00:00:52,470 --> 00:00:48,960
another set revealed a second planet

23
00:00:54,389 --> 00:00:52,480
named toi 700c a little farther out

24
00:00:56,389 --> 00:00:54,399
the deeper shorter transit means the

25
00:00:59,110 --> 00:00:56,399
planet is larger than the first and the

26
00:01:02,310 --> 00:00:59,120
plane of its orbit is slightly tipped

27
00:01:05,109 --> 00:01:02,320
a final set of transits showed toi 700d

28
00:01:07,350 --> 00:01:05,119
orbiting even farther out

29
00:01:09,350 --> 00:01:07,360
tess observed the system for nearly 11

30
00:01:11,030 --> 00:01:09,360
months and saw each planet transit

31
00:01:13,030 --> 00:01:11,040
multiple times

32
00:01:15,270 --> 00:01:13,040
scientists determine that the inner and

33
00:01:16,710 --> 00:01:15,280
outer planets are almost earth size and

34
00:01:18,630 --> 00:01:16,720
may be rocky

35
00:01:21,350 --> 00:01:18,640
the middle world is more than twice as

36
00:01:23,749 --> 00:01:21,360
large and most likely made of gas

37
00:01:26,390 --> 00:01:23,759
all three may be tidally locked rotating

38
00:01:28,310 --> 00:01:26,400

just once each orbit so the same side

39
00:01:31,830 --> 00:01:28,320
always faces the star

40
00:01:34,390 --> 00:01:31,840
but most importantly toi 700d is within

41
00:01:36,149 --> 00:01:34,400
the star's habitable zone

42
00:01:39,190 --> 00:01:36,159
scientists wanted independent

43
00:01:41,190 --> 00:01:39,200
confirmation of toi 700d so they

44
00:01:42,789 --> 00:01:41,200
monitored its star with nasa's spitzer

45
00:01:44,789 --> 00:01:42,799
space telescope

46
00:01:47,190 --> 00:01:44,799
spitzer saw a clear transit from the

47
00:01:48,950 --> 00:01:47,200
outer planet affirming its existence and

48
00:01:51,030 --> 00:01:48,960
improving scientist certainty of the

49
00:01:53,990 --> 00:01:51,040
planet's size

50
00:01:55,990 --> 00:01:54,000
toi 700d is one of only a few

51
00:01:57,510 --> 00:01:56,000
earth-sized planets found in potential

52
00:01:59,910 --> 00:01:57,520
habitable zones

53
00:02:03,510 --> 00:01:59,920
others include discoveries by kepler and

54
00:02:07,030 --> 00:02:03,520
several planets in the trappist-1 system

55
00:02:09,029 --> 00:02:07,040
because toi 700 is bright and nearby the

56
00:02:10,790 --> 00:02:09,039
planets are good candidates for precise

57
00:02:12,630 --> 00:02:10,800
mass measurements by ground-based

58
00:02:14,470 --> 00:02:12,640
telescopes

59
00:02:16,630 --> 00:02:14,480
future missions may also tell us if the

60
00:02:18,309 --> 00:02:16,640
worlds have atmospheres but scientists

61
00:02:19,750 --> 00:02:18,319
need to know what kinds of signals to

62
00:02:21,670 --> 00:02:19,760
look for

63
00:02:23,430 --> 00:02:21,680

researchers at nasa's goddard space

64
00:02:25,190 --> 00:02:23,440
flight center created models of the

65
00:02:26,470 --> 00:02:25,200
planet to explore its potential

66
00:02:28,470 --> 00:02:26,480
conditions

67
00:02:30,869 --> 00:02:28,480
one version is a water covered world

68
00:02:32,949 --> 00:02:30,879
with an atmosphere similar to early mars

69
00:02:37,030 --> 00:02:32,959
but denser another looks like a

70
00:02:38,710 --> 00:02:37,040
completely dry version of today's earth

71
00:02:40,710 --> 00:02:38,720
both models have vastly different

72
00:02:42,470 --> 00:02:40,720
surface temperatures

73
00:02:44,229 --> 00:02:42,480
light passing through their atmospheres

74
00:02:47,110 --> 00:02:44,239
creates distinct signals because

75
00:02:49,509 --> 00:02:47,120
different molecules are present

76
00:02:51,430 --> 00:02:49,519
by simulating these data now scientists

77
00:02:54,070 --> 00:02:51,440
can make predictions for real future

78
00:02:57,509 --> 00:02:54,080
observations and narrow the range of toi

79
00:02:59,270 --> 00:02:57,519
700d's possible conditions

80
00:03:02,550 --> 00:02:59,280
we still have much to learn about the

81
00:03:05,350 --> 00:03:02,560
toi 700 system but thanks to tess

82
00:03:07,350 --> 00:03:05,360
spitzer and the work of many scientists