
science @ NASA

1
00:00:09,070 --> 00:00:07,340
big weather on hot Jupiters presented by

2
00:00:11,509 --> 00:00:09,080
science at NASA

3
00:00:13,280 --> 00:00:11,519
among the hundreds of new planets

4
00:00:15,980 --> 00:00:13,290
discovered by NASA's Kepler spacecraft

5
00:00:19,310 --> 00:00:15,990
are a class of exotic worlds known as

6
00:00:21,349 --> 00:00:19,320
hot Jupiters unlike the giant planets of

7
00:00:24,109 --> 00:00:21,359
our own solar system which remain at a

8
00:00:25,880 --> 00:00:24,119
safe distance from the Sun these worlds

9
00:00:28,730 --> 00:00:25,890
are reckless visitors to their parent

10
00:00:31,250 --> 00:00:28,740
stars they speed around in orbits a

11
00:00:33,470 --> 00:00:31,260
fraction the size of Mercury's blasted

12
00:00:35,360 --> 00:00:33,480
on just one side by starlight hundreds

13
00:00:37,069 --> 00:00:35,370

of times more intense than the gentle

14
00:00:40,069 --> 00:00:37,079
heating experienced by Jupiter here at

15
00:00:41,900 --> 00:00:40,079
home meteorologists watching this video

16
00:00:44,450 --> 00:00:41,910
are probably wondering what kind of

17
00:00:47,460 --> 00:00:44,460
weather a world like that might have the

18
00:00:49,230 --> 00:00:47,470
short answer is big

19
00:00:51,060 --> 00:00:49,240
Heather Knutson of Caltech made the

20
00:00:54,240 --> 00:00:51,070
first weather map of a hot Jupiter in

21
00:00:55,530 --> 00:00:54,250
2007 it's not as simple as taking a

22
00:00:58,380 --> 00:00:55,540
picture and voila

23
00:01:00,330 --> 00:00:58,390
we see the weather says Knutson these

24
00:01:02,940 --> 00:01:00,340
planets are hundreds of light years from

25
00:01:06,000 --> 00:01:02,950
Earth and they are nearly overwhelmed by

26
00:01:08,280 --> 00:01:06,010
the glare of their parent stars even to

27
00:01:10,970 --> 00:01:08,290
see the planet as a single pixel next to

28
00:01:13,680 --> 00:01:10,980
the star would be a huge accomplishment

29
00:01:15,270 --> 00:01:13,690
instead Knutson and colleagues use the

30
00:01:18,240 --> 00:01:15,280
trick dreamed up by Nick Cowen of

31
00:01:20,490 --> 00:01:18,250
Northwestern University the key she

32
00:01:23,070 --> 00:01:20,500
explains is that most hot Jupiters are

33
00:01:25,980 --> 00:01:23,080
tidally locked to their stars just like

34
00:01:27,900 --> 00:01:25,990
the moon is tidally locked to earth this

35
00:01:30,750 --> 00:01:27,910
means that they have a permanent de side

36
00:01:33,140 --> 00:01:30,760
and a permanent night side as they orbit

37
00:01:35,760 --> 00:01:33,150
they exhibit phases again like the moon

38
00:01:38,040 --> 00:01:35,770

by measuring the infrared brightness of

39
00:01:39,630 --> 00:01:38,050
the planet as a function of its phase we

40
00:01:42,690 --> 00:01:39,640
can make a rudimentary map of

41
00:01:44,400 --> 00:01:42,700
temperature versus longitude nasa's

42
00:01:46,020 --> 00:01:44,410
spitzer space telescope is the only

43
00:01:48,719 --> 00:01:46,030
infrared Observatory with the

44
00:01:50,460 --> 00:01:48,729
sensitivity to do this work since

45
00:01:53,550 --> 00:01:50,470
Knutson kick-started the research in

46
00:01:55,760 --> 00:01:53,560
2007 nearly a dozen hot Jupiters have

47
00:01:58,560 --> 00:01:55,770
been mapped by astronomers using spitzer

48
00:02:01,770 --> 00:01:58,570
the most recent study led by nicole

49
00:02:05,219 --> 00:02:01,780
lewis of MIT shows a gas giant named hat

50
00:02:08,820 --> 00:02:05,229
P to B we can see daytime temperatures

51
00:02:11,060 --> 00:02:08,830
as high as 2,400 Kelvin says Lewis while

52
00:02:14,250 --> 00:02:11,070
the night side drops below 1200 Kelvin

53
00:02:17,100 --> 00:02:14,260
even at night she marvels this planet is

54
00:02:19,530 --> 00:02:17,110
ten times hotter than Jupiter these

55
00:02:21,720 --> 00:02:19,540
exoplanet maps may seem crude compared

56
00:02:23,130 --> 00:02:21,730
to what we're accustomed to on earth but

57
00:02:24,840 --> 00:02:23,140
they are a fantastic accomplishment

58
00:02:28,050 --> 00:02:24,850
considering that the planets are

59
00:02:30,150 --> 00:02:28,060
trillions of miles away the maps show

60
00:02:33,110 --> 00:02:30,160
huge day/night temperature differences

61
00:02:35,250 --> 00:02:33,120
sometimes exceeding 1000 degrees

62
00:02:38,280 --> 00:02:35,260
researchers believe these thermal

63
00:02:40,650 --> 00:02:38,290

gradients drive ferocious winds on hat

64
00:02:43,309 --> 00:02:40,660
p2 the winds are probably blowing

65
00:02:45,530 --> 00:02:43,319
thousands of miles per hour

66
00:02:46,880 --> 00:02:45,540
without regular pictures researchers

67
00:02:50,270 --> 00:02:46,890
can't say what this kind of windy

68
00:02:51,890 --> 00:02:50,280
weather looks like nevertheless Knutson

69
00:02:54,830 --> 00:02:51,900
is willing to speculate using climate

70
00:02:58,059 --> 00:02:54,840
models of Jupiter as a guide weather on

71
00:03:01,069 --> 00:02:58,069
hot Jupiters she predicts is really big

72
00:03:03,170 --> 00:03:01,079
over the years planetary scientists have

73
00:03:04,729 --> 00:03:03,180
developed computer models to reproduce

74
00:03:07,880 --> 00:03:04,739
the storms and cloud belts in Jupiter's

75
00:03:10,280 --> 00:03:07,890
atmosphere if you take those models and

76
00:03:13,190 --> 00:03:10,290
turn up the heat weather patterns become

77
00:03:15,649 --> 00:03:13,200
super-sized for instance on a hot

78
00:03:17,390 --> 00:03:15,659
Jupiter the Great Red Spot might grow as

79
00:03:19,819 --> 00:03:17,400
large as a quarter the size of the

80
00:03:22,460 --> 00:03:19,829
planet and manifest itself in both the

81
00:03:24,860 --> 00:03:22,470
northern and southern hemispheres just

82
00:03:27,670 --> 00:03:24,870
imagine what that would look like a pair

83
00:03:30,199 --> 00:03:27,680
of giant eyes staring out into space

84
00:03:32,210 --> 00:03:30,209
meanwhile Jupiter's famous belts would

85
00:03:34,449 --> 00:03:32,220
widen so much that only two or three

86
00:03:36,920 --> 00:03:34,459
would fit across the planets girth

87
00:03:39,640 --> 00:03:36,930
ordinary clouds of water and methane

88
00:03:42,319 --> 00:03:39,650

couldn't form in such a hot environment

89
00:03:43,970 --> 00:03:42,329
instead Knutson speculates that hot

90
00:03:47,689 --> 00:03:43,980
Jupiters might have clouds made of

91
00:03:49,369 --> 00:03:47,699
silicate that is rock clouds silicates

92
00:03:51,649 --> 00:03:49,379
are predicted to condense in such an

93
00:03:53,539 --> 00:03:51,659
environment she says we're already

94
00:03:56,000 --> 00:03:53,549
getting some hints that clouds might be

95
00:03:58,399 --> 00:03:56,010
common on these planets but we don't yet

96
00:04:00,740 --> 00:03:58,409
know if they're made of rock for now

97
00:04:02,869 --> 00:04:00,750
just one thing is certain the

98
00:04:05,780 --> 00:04:02,879
meteorology of hot Jupiters is out of

99
00:04:07,759 --> 00:04:05,790
this world for more news about weird