

The image features a vibrant, textured background of the Sun's surface, transitioning from bright yellow and orange at the bottom to deep red and black at the top. A small, detailed satellite, the Parker Solar Probe, is visible in the upper right corner, appearing to orbit the Sun. The text is centered and reads:

**PARKER SOLAR PROBE
TOUCHES SUN**

1
00:00:05,190 --> 00:00:02,550
liftoff of the mighty delta iv heavy

2
00:00:08,390 --> 00:00:05,200
rocket in august 2018 in cape canaveral

3
00:00:10,950 --> 00:00:08,400
florida nasa launched parker solar probe

4
00:00:13,749 --> 00:00:10,960
to touch the sun after spending a few

5
00:00:17,910 --> 00:00:13,759
years spiraling closer to our star the

6
00:00:19,830 --> 00:00:17,920
spacecraft has finally arrived

7
00:00:22,390 --> 00:00:19,840
it is amazing

8
00:00:23,750 --> 00:00:22,400
pakistan folk is touching the sun and

9
00:00:25,750 --> 00:00:23,760
this is nora

10
00:00:27,429 --> 00:00:25,760
the project scientist of the mission he

11
00:00:29,589 --> 00:00:27,439
has been waiting for this moment since

12
00:00:31,509 --> 00:00:29,599
the beginning of his career

13
00:00:33,910 --> 00:00:31,519

this is a dream come true one of the

14

00:00:35,910 --> 00:00:33,920

major goals for the pakistan mission is

15

00:00:37,590 --> 00:00:35,920

to fly through the solar corona and we

16

00:00:40,069 --> 00:00:37,600

are doing that now

17

00:00:41,990 --> 00:00:40,079

so what does it mean to touch the sun to

18

00:00:43,430 --> 00:00:42,000

answer that we need to look at the sun

19

00:00:45,270 --> 00:00:43,440

structure

20

00:00:48,229 --> 00:00:45,280

unlike earth the sun doesn't have a

21

00:00:50,229 --> 00:00:48,239

solid surface it's a giant ball of hot

22

00:00:51,830 --> 00:00:50,239

plasma that's held together by its own

23

00:00:53,590 --> 00:00:51,840

gravity

24

00:00:54,630 --> 00:00:53,600

solar material flows out from the

25

00:00:56,950 --> 00:00:54,640

surface

26

00:00:59,670 --> 00:00:56,960

but around the sun it's bound by the

27

00:01:01,830 --> 00:00:59,680

sun's gravity and magnetic field this

28

00:01:04,710 --> 00:01:01,840

material forms the sun's atmosphere the

29

00:01:07,030 --> 00:01:04,720

corona eventually some of this hot and

30

00:01:09,350 --> 00:01:07,040

fast solar material escapes the pull of

31

00:01:10,710 --> 00:01:09,360

the sun and gushes out into space as

32

00:01:12,469 --> 00:01:10,720

solar wind

33

00:01:15,030 --> 00:01:12,479

the boundary that marks the edge of the

34

00:01:17,749 --> 00:01:15,040

sun's atmosphere is known as the alaphane

35

00:01:19,670 --> 00:01:17,759

critical surface we didn't know exactly

36

00:01:21,990 --> 00:01:19,680

where this boundary was

37

00:01:24,550 --> 00:01:22,000

but for the first time in history a

38

00:01:26,950 --> 00:01:24,560

spacecraft has crossed it parker solar

39

00:01:30,149 --> 00:01:26,960

probe ventured into the corona touching

40

00:01:32,230 --> 00:01:30,159

solar material still bound to the sun

41

00:01:34,230 --> 00:01:32,240

the wispy corona is too faint to see

42

00:01:37,429 --> 00:01:34,240

most of the time but it's revealed

43

00:01:39,350 --> 00:01:37,439

during total solar eclipses

44

00:01:41,749 --> 00:01:39,360

for centuries we've been studying the

45

00:01:43,830 --> 00:01:41,759

sun's atmosphere during eclipses because

46

00:01:46,789 --> 00:01:43,840

it's important for understanding how our

47

00:01:48,789 --> 00:01:46,799

star influences life in the solar system

48

00:01:51,270 --> 00:01:48,799

but much about the corona remains a

49

00:01:53,350 --> 00:01:51,280

mystery two of the most challenging

50

00:01:55,109 --> 00:01:53,360

scientific mysteries in astrophysics

51
00:01:56,149 --> 00:01:55,119
occur in a region that we call solar

52
00:01:57,590 --> 00:01:56,159
corona

53
00:02:00,389 --> 00:01:57,600
the first mystery is about the

54
00:02:02,550 --> 00:02:00,399
temperature the corona is about 300

55
00:02:04,950 --> 00:02:02,560
times hotter than the photosphere the

56
00:02:07,030 --> 00:02:04,960
visible surface of the sun below

57
00:02:09,029 --> 00:02:07,040
secondly there's a constant stream of

58
00:02:11,510 --> 00:02:09,039
particles flowing from the sun known as

59
00:02:13,510 --> 00:02:11,520
the solar wind it accelerates up to

60
00:02:15,910 --> 00:02:13,520
millions of miles per hour out of the

61
00:02:18,470 --> 00:02:15,920
corona and we don't know how

62
00:02:20,869 --> 00:02:18,480
solarwind can disrupt our satellites and

63
00:02:23,270 --> 00:02:20,879

technology to better protect them we

64

00:02:25,589 --> 00:02:23,280

need to go where the solar wind starts

65

00:02:28,150 --> 00:02:25,599

in the corona so heading there has been

66

00:02:30,390 --> 00:02:28,160

a key goal of nasa's for a while

67

00:02:33,830 --> 00:02:30,400

we first proposed the idea of sending a

68

00:02:35,750 --> 00:02:33,840

spacecraft to the sun in 1958 we didn't

69

00:02:38,390 --> 00:02:35,760

have the technology to withstand the

70

00:02:41,190 --> 00:02:38,400

journey until the 2000s

71

00:02:43,110 --> 00:02:41,200

since its launch in 2018 parker has been

72

00:02:45,830 --> 00:02:43,120

heading towards our star

73

00:02:47,509 --> 00:02:45,840

then in april 2021 during parker's

74

00:02:50,390 --> 00:02:47,519

eighth orbit around the sun the

75

00:02:52,710 --> 00:02:50,400

spacecraft was around 20 solar radii or

76

00:02:54,949 --> 00:02:52,720

8 million miles from the sun's surface

77

00:02:58,309 --> 00:02:54,959

when it crossed into the corona

78

00:03:00,790 --> 00:02:58,319

this is a huge milestone it took us over

79

00:03:03,270 --> 00:03:00,800

six decades to come to this point

80

00:03:05,830 --> 00:03:03,280

as parker entered the corona its whisper

81

00:03:08,149 --> 00:03:05,840

instrument took these images streams of

82

00:03:10,390 --> 00:03:08,159

plasma surrounded the spacecraft and

83

00:03:13,430 --> 00:03:10,400

parker's other instruments detected that

84

00:03:16,390 --> 00:03:13,440

the magnetic conditions had changed

85

00:03:18,710 --> 00:03:16,400

outside the corona solar wind gushes out

86

00:03:20,869 --> 00:03:18,720

pushing solar material away at high

87

00:03:22,470 --> 00:03:20,879

speeds so that it can't return back to

88

00:03:25,110 --> 00:03:22,480

the sun's surface

89

00:03:27,270 --> 00:03:25,120

inside the corona the sun's magnetic

90

00:03:29,750 --> 00:03:27,280

field becomes much stronger

91

00:03:30,789 --> 00:03:29,760

solar material is slower and tethered to

92

00:03:33,670 --> 00:03:30,799

the sun

93

00:03:35,430 --> 00:03:33,680

instead of a smooth divide parker found

94

00:03:37,430 --> 00:03:35,440

that the boundary between these two

95

00:03:39,750 --> 00:03:37,440

sides is wrinkly

96

00:03:41,430 --> 00:03:39,760

these bumpy ridges are created from huge

97

00:03:42,630 --> 00:03:41,440

flows of plasma traveling out of the

98

00:03:44,949 --> 00:03:42,640

corona

99

00:03:47,350 --> 00:03:44,959

scientists are not sure why this happens

100

00:03:48,630 --> 00:03:47,360

but as parker gets closer we're finding

101
00:03:50,869 --> 00:03:48,640
more clues

102
00:03:52,789 --> 00:03:50,879
before entering the corona parker had

103
00:03:55,509 --> 00:03:52,799
seen kinks in the solar wind where it

104
00:03:56,949 --> 00:03:55,519
would momentarily double back on itself

105
00:03:59,670 --> 00:03:56,959
scientists called these features in the

106
00:04:02,229 --> 00:03:59,680
solar wind switchbacks but no one knew

107
00:04:05,350 --> 00:04:02,239
how or where they formed

108
00:04:07,830 --> 00:04:05,360
in 2021 the spacecraft finally tracked

109
00:04:10,309 --> 00:04:07,840
switchbacks to one of their origins

110
00:04:13,030 --> 00:04:10,319
as parker got even closer to the sun it

111
00:04:15,030 --> 00:04:13,040
detected bursts of switchbacks

112
00:04:18,550 --> 00:04:15,040
scientists trace these bursts all the

113
00:04:20,789 --> 00:04:18,560

way to the visible surface of the sun

114

00:04:23,110 --> 00:04:20,799

here we see distinct cells

115

00:04:25,430 --> 00:04:23,120

as heat rises beneath these convection

116

00:04:28,710 --> 00:04:25,440

cells churn and create funnels of

117

00:04:30,870 --> 00:04:28,720

magnetic energy above the surface

118

00:04:33,670 --> 00:04:30,880

scientists found that switchbacks form

119

00:04:36,230 --> 00:04:33,680

inside these funnels before rising into

120

00:04:37,749 --> 00:04:36,240

the corona and beyond

121

00:04:39,590 --> 00:04:37,759

this is only one piece of the

122

00:04:43,030 --> 00:04:39,600

switchbacks puzzle though

123

00:04:45,270 --> 00:04:43,040

exactly how they form is still unknown

124

00:04:48,070 --> 00:04:45,280

over the next few years parker will keep

125

00:04:51,270 --> 00:04:48,080

looking for clues as it explores our sun

126

00:04:53,430 --> 00:04:51,280

the only star we can study up close

127

00:04:54,710 --> 00:04:53,440

the sun is also the only star known to

128

00:04:56,790 --> 00:04:54,720

support life

129

00:04:59,510 --> 00:04:56,800

so understanding it is critical as we

130

00:05:01,270 --> 00:04:59,520

search for life beyond our solar system

131

00:05:03,670 --> 00:05:01,280

that will link directly into the

132

00:05:06,310 --> 00:05:03,680

question are we alone in this universe