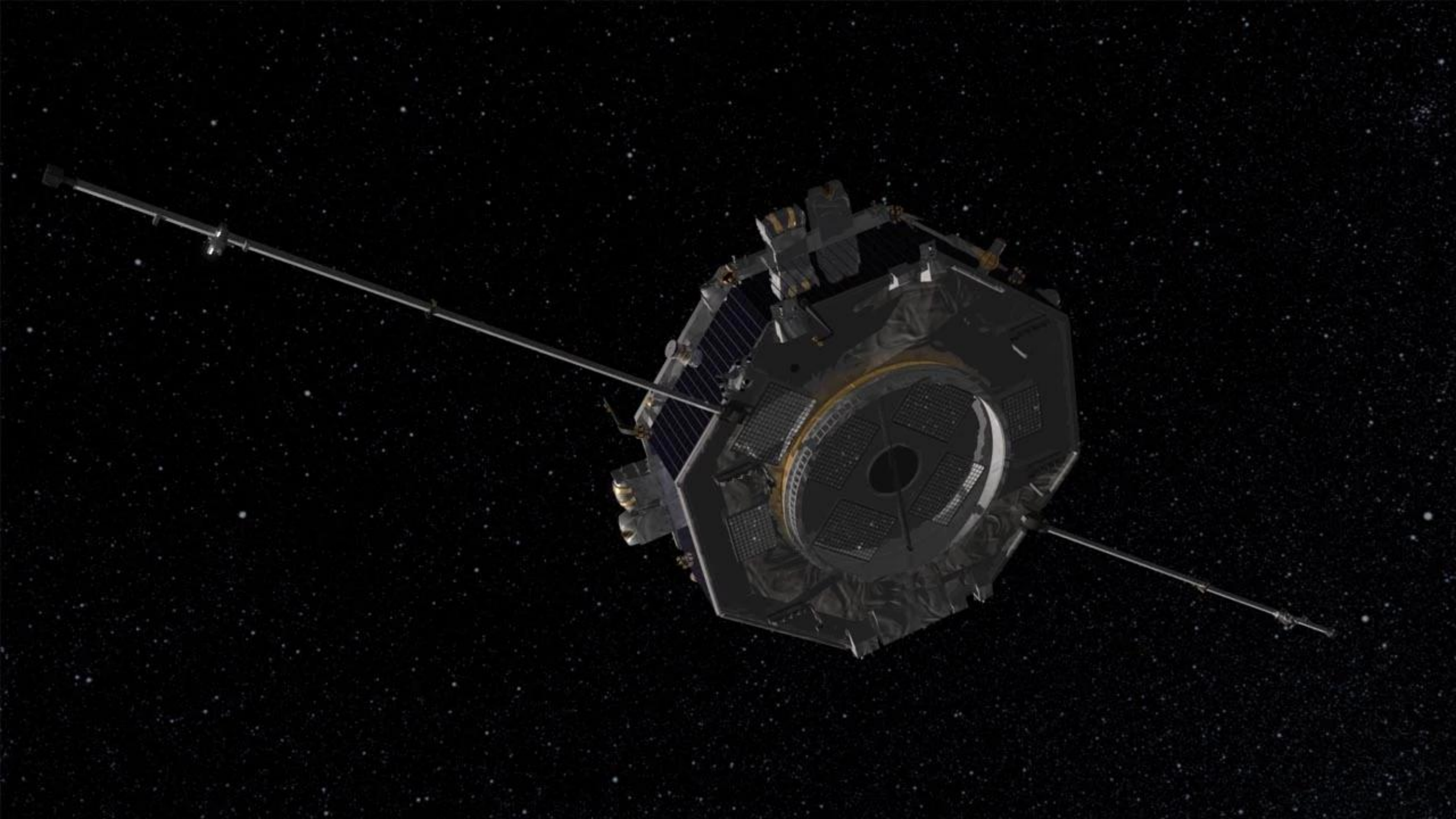

1
00:00:14,140 --> 00:00:11,230
[Music]

2
00:00:16,580 --> 00:00:14,150
magnetic reconnection is the process of

3
00:00:17,810 --> 00:00:16,590
disconnecting or connecting the magnetic

4
00:00:19,880 --> 00:00:17,820
fields to each other

5
00:00:22,099 --> 00:00:19,890
directing energy into the earth on the

6
00:00:24,019 --> 00:00:22,109
day side and then letting it go on the

7
00:00:26,870 --> 00:00:24,029
night side and the interplay between

8
00:00:29,960 --> 00:00:26,880
those two is what produces all la space

9
00:00:32,089 --> 00:00:29,970
weather around the earth that has big

10
00:00:34,610 --> 00:00:32,099
effects can damage our spacecraft can

11
00:00:36,560 --> 00:00:34,620
hurt astronauts can upset the flow of

12
00:00:38,780 --> 00:00:36,570
electron or G and our electric grid on

13
00:00:41,330 --> 00:00:38,790

the surface of the earth MMS is a

14
00:00:44,030 --> 00:00:41,340
mission with four spacecraft that are

15
00:00:46,389 --> 00:00:44,040
traveling in formation in an orbit that

16
00:00:49,880 --> 00:00:46,399
takes them out into two special places

17
00:00:53,479 --> 00:00:49,890
near the earth one upstream toward the

18
00:00:54,950 --> 00:00:53,489
Sun on downstream away from the Sun both

19
00:00:57,709 --> 00:00:54,960
of those places have magnetic

20
00:01:01,069 --> 00:00:57,719
reconnection we have never before NMS

21
00:01:02,990 --> 00:01:01,079
had the ability to essentially run the

22
00:01:05,960 --> 00:01:03,000
camera fast enough to catch it as it

23
00:01:08,810 --> 00:01:05,970
goes by to make mini measurements per

24
00:01:10,850 --> 00:01:08,820
second the science payload for her mass

25
00:01:14,480 --> 00:01:10,860
is all mounted on a single deck plate

26
00:01:16,460 --> 00:01:14,490
but it consists of some 25 boxes per

27
00:01:18,920 --> 00:01:16,470
spacecraft divided into three general

28
00:01:20,539 --> 00:01:18,930
groups of instruments that's those for

29
00:01:23,420 --> 00:01:20,549
measuring fields electric and magnetic

30
00:01:25,520 --> 00:01:23,430
those for measuring plasmas in a third

31
00:01:27,560 --> 00:01:25,530
for measuring energetic particles the

32
00:01:29,030 --> 00:01:27,570
magnetic field sensors are out on arms

33
00:01:31,160 --> 00:01:29,040
that extend away from the spacecraft

34
00:01:33,530 --> 00:01:31,170
they're fixed but the spacecraft is

35
00:01:36,260 --> 00:01:33,540
spinning slowly about once every 20

36
00:01:36,890 --> 00:01:36,270
seconds the electric field is quite a

37
00:01:39,950 --> 00:01:36,900
bit different

38
00:01:41,899 --> 00:01:39,960

it consists of four wires that extend

39
00:01:44,600 --> 00:01:41,909
out away from the spacecraft with a ball

40
00:01:47,420 --> 00:01:44,610
on the end of each of them that actually

41
00:01:48,740 --> 00:01:47,430
contacts the plasma all four of those

42
00:01:51,200 --> 00:01:48,750
are spinning around with the spacecraft

43
00:01:53,510 --> 00:01:51,210
at this twenty second period and then

44
00:01:55,580 --> 00:01:53,520
there's a third axis that extends their

45
00:01:56,870 --> 00:01:55,590
booms that extend along the spin axis of

46
00:01:58,789 --> 00:01:56,880
the spacecraft both upward and downward

47
00:02:00,560 --> 00:01:58,799
with a probe at the ends you've got

48
00:02:03,319 --> 00:02:00,570
three components of the electric field

49
00:02:05,719 --> 00:02:03,329
they can measure everything from up to

50
00:02:07,670 --> 00:02:05,729
small Wiggles and vibrations of the

51
00:02:08,740 --> 00:02:07,680
electric field another sensor called the

52
00:02:12,220 --> 00:02:08,750
searchcoil magnet

53
00:02:15,100 --> 00:02:12,230
that is just a loop of wire connected to

54
00:02:16,600 --> 00:02:15,110
a suitable amplifier and is designed to

55
00:02:18,490 --> 00:02:16,610
measure the fluctuations at higher

56
00:02:21,940 --> 00:02:18,500
frequencies then you could get with the

57
00:02:25,420 --> 00:02:21,950
DC magnetometers for the plasmas there

58
00:02:26,830 --> 00:02:25,430
are eight boxes two boxes at each of the

59
00:02:28,990 --> 00:02:26,840
four points of the compass on the

60
00:02:29,710 --> 00:02:29,000
spacecraft those are equally spaced all

61
00:02:33,180 --> 00:02:29,720
the way around the spacecraft

62
00:02:35,320 --> 00:02:33,190
essentially that is a real key

63
00:02:38,020 --> 00:02:35,330

ingredient for being able to see the

64
00:02:40,360 --> 00:02:38,030
entire sky instantaneously without

65
00:02:42,850 --> 00:02:40,370
waiting for the spacecraft to spin then

66
00:02:44,949 --> 00:02:42,860
there's also a hot plasma composition

67
00:02:47,310 --> 00:02:44,959
analyzer one per spacecraft it has a

68
00:02:50,500 --> 00:02:47,320
sensor head that looks all around in a

69
00:02:52,600 --> 00:02:50,510
360-degree annulus sticks out the side

70
00:02:55,240 --> 00:02:52,610
of the spacecraft and sweeps out the

71
00:02:57,520 --> 00:02:55,250
whole sky twice per spin it measures the

72
00:02:59,430 --> 00:02:57,530
chemical species of the particles the

73
00:03:01,780 --> 00:02:59,440
third set are the energetic particles

74
00:03:03,130 --> 00:03:01,790
analyzers and they are measuring much

75
00:03:05,530 --> 00:03:03,140
more energetic particles that are

76
00:03:07,930 --> 00:03:05,540
accelerated by the reconnection process

77
00:03:09,670 --> 00:03:07,940
ultimately the thing we will be doing is

78
00:03:11,860 --> 00:03:09,680
comparing our observations with

79
00:03:14,199 --> 00:03:11,870
simulations of the entire magnetosphere

80
00:03:16,780 --> 00:03:14,209
as it is influenced by the solar wind

81
00:03:19,150 --> 00:03:16,790
coming in down to the details of what

82
00:03:20,949 --> 00:03:19,160
reconnection is occurring people who do

83
00:03:23,170 --> 00:03:20,959
those simulations that try to apply them

84
00:03:26,620 --> 00:03:23,180
to all other kinds of places like in the

85
00:03:30,970 --> 00:03:26,630
solar atmosphere at other Astrophysical

86
00:03:32,170 --> 00:03:30,980
stars and other objects and they are

87
00:03:34,270 --> 00:03:32,180
very interested in whether those

88
00:03:36,160 --> 00:03:34,280

simulations are accurate and reflect

89
00:03:37,630 --> 00:03:36,170
reality well this is going to be the

90
00:03:40,120 --> 00:03:37,640
first time we actually bump them up

91
00:03:42,310 --> 00:03:40,130
against hard data on what's going on in

92
00:03:43,780 --> 00:03:42,320
their eye I'm almost certain I'm very

93
00:03:45,819 --> 00:03:43,790
certain they're going to learn something

94
00:03:47,040 --> 00:03:45,829
from that and the simulations will get

95
00:03:49,110 --> 00:03:47,050
better

96
00:03:51,060 --> 00:03:49,120
we're doing a measure thing at rates

97
00:03:53,610 --> 00:03:51,070
that have never been done before and in

98
00:03:56,880 --> 00:03:53,620
places that have been hard to reach or

99
00:04:01,110 --> 00:03:56,890
even see because they go by too fast to