



1
00:00:00,000 --> 00:00:02,160
tone

2
00:00:04,180 --> 00:00:06,160
music

3
00:00:06,180 --> 00:00:09,380
Michael Hesse: The MMS Mission is a mission

4
00:00:09,400 --> 00:00:12,380
consisting of 4 spacecraft which will fly in close constellation

5
00:00:12,400 --> 00:00:15,450
to measure a process called magnetic reconnection.

6
00:00:15,470 --> 00:00:18,620
John Dorelli: The universe is full of plasma and it's full of magnetic fields,

7
00:00:18,640 --> 00:00:21,790
and all over the place in the universe,

8
00:00:21,810 --> 00:00:24,800
you have one plasma colliding with another. An example of that is

9
00:00:24,820 --> 00:00:27,980
the solar wind coming in and colliding with Earth's magnetosphere.

10
00:00:28,000 --> 00:00:31,440
The magnetic energy in the plasma, some fraction of that

11
00:00:31,460 --> 00:00:34,560
of the magnetic energy is converted very rapidly into plasma energy.

12
00:00:34,580 --> 00:00:37,600
You can think of it as kind of like a magnetic explosion.

13
00:00:37,620 --> 00:00:40,600

The reason this is important is

14

00:00:40,620 --> 00:00:43,740

these explosions drive a lot of the weather

15

00:00:43,760 --> 00:00:46,750

patterns that we see in the magnetosphere, so what space scientists

16

00:00:46,770 --> 00:00:49,920

like to refer to as space weather.

17

00:00:49,940 --> 00:00:52,930

These space weather phenomena can have impact

18

00:00:52,950 --> 00:00:56,090

on our every day lives. It can actually affect communications

19

00:00:56,110 --> 00:00:59,170

satellites, the power grid. So, we would really like to understand

20

00:00:59,190 --> 00:01:02,180

how these magnetic explosions work.

21

00:01:02,200 --> 00:01:05,260

Michael Hesse: We need to measure magnetic reconnection in more than one location.

22

00:01:05,280 --> 00:01:08,340

Basically, how it varies in space, how it varies

23

00:01:08,360 --> 00:01:11,530

all 3 spacial dimensions. That requires a

24

00:01:11,550 --> 00:01:14,700

a tetrahedron. The additional, fantastic benefit

25

00:01:14,720 --> 00:01:17,760

that that provides is that it will actually enable

26

00:01:17,780 --> 00:01:21,050

us to recognize that we are looking at a reconnection region

27

00:01:21,070 --> 00:01:24,060

much easier than a single spacecraft. John Dorelli: The idea situation

28

00:01:24,080 --> 00:01:27,220

we would like the 4 spacecraft to kind of be surrounding

29

00:01:27,240 --> 00:01:30,610

this region where the explosion is happening.

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00:01:30,630 --> 00:01:33,780

The separation of the spacecraft is about 10 - 100 kilometers, which makes

31

00:01:33,800 --> 00:01:36,850

it may seem like a long distance, but in terms of the magnetosphere,

32

00:01:36,870 --> 00:01:39,850

which is absolutely huge, this is really a microscopic

33

00:01:39,870 --> 00:01:42,850

region we are trying to cover. Micheal Hesse: MSS has, in a nutshell,

34

00:01:42,870 --> 00:01:46,220

2 orbital phases which are designed to study

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00:01:46,240 --> 00:01:49,220

reconnection.

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00:01:49,240 --> 00:01:52,470

John Dorelli: On the day side, you have situation where the solar wind is just constantly running

37

00:01:52,490 --> 00:01:55,730

into Earth's magnetic field. This is really great for MMS,

38

00:01:55,750 --> 00:01:58,880

because we know at some point MMS is going

39

00:01:58,900 --> 00:02:02,030

encounter this region. Our hope is that

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00:02:02,050 --> 00:02:05,220

since this process is always happening we are gonna get lucky

41

00:02:05,240 --> 00:02:08,300

and actually fly right through the magnetic

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00:02:08,320 --> 00:02:11,300

explosion as it is happening. Now, on the nightside,

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00:02:11,320 --> 00:02:14,300

the situation is a little bit different. What happens you have a more

44

00:02:14,320 --> 00:02:17,520

gradual build up of magnetic energy in the tale,

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00:02:17,540 --> 00:02:20,700

and these reconnection processes, these magnetic explosions,

46

00:02:20,720 --> 00:02:23,710

can just sort of pop off randomly

47

00:02:23,730 --> 00:02:26,840

we don't really know when it's gonna happen or when it's gonna happen in the tail.

48

00:02:26,860 --> 00:02:30,010

Michael Hesse: We need to understand both of those, if we want to understand how the magnetosphere works

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00:02:30,030 --> 00:02:33,210

And we believe that both of those scenarios are also very important for us

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00:02:33,230 --> 00:02:36,220

for other applications, such as on the sun,

51
00:02:36,240 --> 00:02:39,400
in the solar wind, in planetary magnetospheres,

52
00:02:39,420 --> 00:02:42,400
and many astrophysical objects

53
00:02:42,420 --> 00:02:45,470
as well as in the laboratory. John Dorelli: We hope that is going to allow us to improve

54
00:02:45,490 --> 00:02:48,470
our models so that we can put the right physics in it

55
00:02:48,490 --> 00:02:51,620
and actually make predictions about where and when reconnection

56
00:02:51,640 --> 00:02:54,800
is going to happen, and this will help us make our space weather models more predicatively powerful

57
00:02:54,820 --> 00:02:57,860
The instruments that are actually going to be measuring

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00:02:57,880 --> 00:03:01,040
the particles in space are collecting them much more rapidly

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00:03:01,060 --> 00:03:04,060
at a much higher cadence than they have

60
00:03:04,080 --> 00:03:07,060
on previous missions, by about a factor of 100.

61
00:03:07,080 --> 00:03:10,100
Whereas it would, you know a previous generation particle instrument

62
00:03:10,120 --> 00:03:13,170
about 3 or 4 seconds

63
00:03:13,190 --> 00:03:16,230

to build up a whole picture of the sky, it's going to take

64

00:03:16,250 --> 00:03:19,240

MMS about 30 milliseconds.

65

00:03:19,260 --> 00:03:22,240

So, it really is sort of game changing technology.

66

00:03:22,260 --> 00:03:25,450

music