
CELEBRATING
10 YEARS OF
STEREO

1
00:00:00,660 --> 00:00:05,280
STEREO is a mission to help us understand what we call space weather,

2
00:00:05,290 --> 00:00:08,330
how the activity on the sun can affect us here

3
00:00:08,330 --> 00:00:12,500
at Earth. The sun will blow out what we call coronal mass ejections.

4
00:00:12,500 --> 00:00:16,300
They're a kind of solar storm, a billion tons of matter, coming at us

5
00:00:16,300 --> 00:00:20,700
at a million miles and hour. They can affect our technology here on Earth, affect power systems,

6
00:00:20,720 --> 00:00:24,680
affect spacecraft. And, so understanding them is not just

7
00:00:24,680 --> 00:00:29,020
a case of their scientific interest, but it also has practical application.

8
00:00:29,040 --> 00:00:33,170
These two spacecraft are giving us two views on the sun instead of just one.

9
00:00:33,190 --> 00:00:37,430
That's really important, because the structures that we are looking at on the sun

10
00:00:37,450 --> 00:00:41,520
that are in the solar wind, which is the sun's atmosphere, blowing out into space,

11
00:00:41,540 --> 00:00:45,620
are really three dimensional objects. To really understand what we are seeing,

12
00:00:45,640 --> 00:00:48,840
we have to look at them from more than one point of view.

13
00:00:50,700 --> 00:00:53,820

CMEs, looking at them, they are kind of like big puffs of

14
00:00:53,840 --> 00:00:57,850
smoke. They have structure, but you can look right through them. In general,

15
00:00:57,870 --> 00:01:01,940
you can sort of think of CMEs as a kind of big, bent Slinky

16
00:01:01,960 --> 00:01:06,030
By looking at it in more than one point of view at the same time, we are able to

17
00:01:06,050 --> 00:01:10,110
confirm that that's roughly what CMEs look like.

18
00:01:10,130 --> 00:01:14,210
The sun's super hot atmosphere is flowing out into space constantly

19
00:01:14,230 --> 00:01:18,270
and this is called the solar wind. Coronal mass ejections are kind of like

20
00:01:18,290 --> 00:01:22,420
storms in the solar wind. We can see from a distance the large

21
00:01:22,440 --> 00:01:26,690
scale of these storms, blowing out into the solar system.

22
00:01:26,710 --> 00:01:30,760
But we can actually sense, in a number of locations, throughout the solar system,

23
00:01:30,780 --> 00:01:34,850
STEREO and other ones, the actual disturbance as it goes by.

24
00:01:34,870 --> 00:01:38,940
So, we can sample the solar wind, see what that's like, sample the CME as it goes by.

25
00:01:38,960 --> 00:01:42,860
Putting all those together, the remote sensing data, the local

26
00:01:43,420 --> 00:01:47,180
conditions, has given a really good, complex picture

27
00:01:47,210 --> 00:01:50,990
of coronal mass ejections, that you can't really get from a single spacecraft.

28
00:01:52,900 --> 00:01:55,140
Comet tails respond to the solar wind,

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00:01:55,240 --> 00:01:59,200
and we've known that for a long time. They are basically charged gas, and they're interacting

30
00:01:59,210 --> 00:02:01,650
with the magnetic field in the solar wind.

31
00:02:01,650 --> 00:02:08,020
What we see here is all this dynamism in this tail. And you can see it's not just sort of a tail,

32
00:02:08,050 --> 00:02:12,210
but that it's responding -- you see there? Right there -- It's responding to this coronal mass ejection

33
00:02:12,230 --> 00:02:16,410
that's coming out from the sun. It helps us understand

34
00:02:16,430 --> 00:02:20,480
how the comet interacts with the solar wind, we can actually

35
00:02:20,500 --> 00:02:24,380
use the comet sort of as a way to probe the solar wind.

36
00:02:26,520 --> 00:02:29,700
STEREO allowed us to see the far side of the sun

37
00:02:29,820 --> 00:02:33,060
for the first time. You look at the sun and you see these bright regions

38
00:02:33,090 --> 00:02:37,200

these active regions, that's where things like solar flares occur, and

39
00:02:37,200 --> 00:02:41,310
really big coronal mass ejections will often come from near those. You might not see

40
00:02:41,350 --> 00:02:44,970
anything on the side of the sun facing you, but something really interesting might be

41
00:02:45,120 --> 00:02:49,140
developing on the far side of the sun. It can be a surprise when it comes around, you know, we might

42
00:02:49,140 --> 00:02:53,290
some inklings that something is going on back there, but we can't really see it without, for instance,

43
00:02:53,770 --> 00:02:54,910
STEREO.

44
00:02:55,670 --> 00:03:00,310
So this was a major, major solar storm. We would have known something had happened, but we wouldn't have

45
00:03:00,310 --> 00:03:05,530
understood its magnitude, just from data from the point of view of the Earth. And if you

46
00:03:05,530 --> 00:03:10,280
look in the coronagraph image to the right, you see that suddenly, there are these little bright

47
00:03:10,310 --> 00:03:14,350
like, bits of snow that show up on the detector. Well, those are

48
00:03:14,370 --> 00:03:17,310
called solar energetic particles. What they are

49
00:03:17,670 --> 00:03:22,540
are particles accelerated almost to the speed of light. Those can be quite

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00:03:22,540 --> 00:03:26,180
hazardous to, for instance, spacecraft or astronauts.

51
00:03:26,650 --> 00:03:30,700
They are related to these coronal mass ejections and other kinds of solar activity

52
00:03:30,720 --> 00:03:34,840
call flares. We would never have even known that it was happening

53
00:03:34,860 --> 00:03:37,740
without spacecraft on the far side of the sun.

54
00:03:38,260 --> 00:03:43,100
By putting all these different points of view onto the sun and space weather

55
00:03:43,130 --> 00:03:46,860
we've been able to understand our star in a way we've never been able to

56
00:03:46,860 --> 00:03:49,120
understand before.

57
00:03:49,120 --> 00:03:53,180
music