1
00:00:12,080 --> 00:00:04,060
Music

2
00:00:12,100 --> 00:00:16,080
Alex: Solar flares and coronal mass ejections do

3
00:00:16,100 --> 00:00:20,110
not always hit Earth. They happen all over the sun and depending

4
00:00:20,130 --> 00:00:24,170
on where on the sun they occur determines whether or not they're

5
00:00:24,190 --> 00:00:28,200
going to travel towards the Earth. Phil: Some of them could be shot off to the side, and just miss

6
00:00:28,220 --> 00:00:32,210
us completely. They could go up, they could go left. Some are

7
00:00:32,230 --> 00:00:36,300
like curveballs, that a pitcher will throw. They could

8
00:00:36,320 --> 00:00:40,310
seemingly come straight for us, and then miss us completely.

9
00:00:40,330 --> 00:00:44,330
Alex: Space weather can have several different effects on the

10
00:00:44,350 --> 00:00:48,360
Earth and the near-Earth environment. In space, it can create

11
00:00:48,380 --> 00:00:52,410
dangerous radiation in the form of particles, which is detrimental

12
00:00:52,430 --> 00:00:56,430
to the health of astronauts. These particles,

13
00:00:56,450 --> 00:01:00,510

as well as solar flares, can cause cause damage to

14
00:01:00,530 --> 00:01:04,590
satellites in near-Earth orbit. In addition,

15
00:01:04,610 --> 00:01:08,640
electromagnetic disturbances created by geomagnetic storms

16
00:01:08,660 --> 00:01:12,670
can affect power transmission on the ground, can also

17
00:01:12,690 --> 00:01:16,750
disrupt communication. But space weather has

18
00:01:16,770 --> 00:01:20,850
no direct effect on human beings themselves. Holly: We are protected

19
00:01:20,870 --> 00:01:24,910
here on the surface of the Earth from solar flares and coronal mass ejections

20
00:01:24,930 --> 00:01:28,930
when they impact the Earth, due to the magnetic field of the Earth called the

21
00:01:28,950 --> 00:01:32,960
magnetosphere, which deflects the magnetic field and the energetic particles

22
00:01:32,980 --> 00:01:36,990
as well as the atmosphere, which absorbs the higher levels of

23
00:01:37,010 --> 00:01:41,050
radiation. Phil: Most of the energy that's associated with a solar flare or

24
00:01:41,070 --> 00:01:45,080
coronal mass ejection doesn't even reach the surface of the Earth. So even

25
00:01:45,100 --> 00:01:49,100
the biggest of flares isn't going to affect you here at Earth.

26
00:01:49,120 --> 00:01:53,120
Music. Alex: When a large solar eruption

27
00:01:53,140 --> 00:01:57,170
occurs, there are generally three things that happen. Each of these takes

28
00:01:57,190 --> 00:02:01,200
a different amount of time to reach the Earth. The solar flare, because

29
00:02:01,220 --> 00:02:05,220
it's light, travels at the speed of light and takes approximately 8 minutes to reach

30
00:02:05,240 --> 00:02:09,260
us. The solar energetic particles are traveling extremely fast

31
00:02:09,280 --> 00:02:13,290
--close to the speed of light, but not exactly the speed of light--so they take

32
00:02:13,310 --> 00:02:17,330
roughly 20 to 30 minutes to reach us.

33
00:02:17,350 --> 00:02:21,350
The coronal mass ejection is much slower, and that takes about

34
00:02:21,370 --> 00:02:25,380
1 to 4 days to reach us. Music.

35
00:02:25,400 --> 00:02:29,460
Holly: The sun goes through what we call a solar activity cycle,

36
00:02:29,480 --> 00:02:33,570
where every 11 years on average, it will go from a very low period of

37
00:02:33,590 --> 00:02:37,610
solar activity--meaning sunspots and solar storms--to another period

38
00:02:37,630 --> 00:02:41,650

of low activity, and in-between it goes through what we call solar maximum. At solar

39
00:02:41,670 --> 00:02:45,670
maximum the sun has a very complicated magnetic field structure, and

40
00:02:45,690 --> 00:02:49,690
therefore it creates a lot more sunspots and a lot more solar storms like flares,

41
00:02:49,710 --> 00:02:53,730
and CMEs. It's very important to be able to

42
00:02:53,750 --> 00:02:57,760
forecast solar events because they can affect our technology, our

43
00:02:57,780 --> 00:03:01,800
satellites, they can cause power grids to be affected. So as we

44
00:03:01,820 --> 00:03:05,830
become more and more technologically advanced, it becomes more important to be able to forecast

45
00:03:05,850 --> 00:03:09,840
such events. Music

46
00:03:09,860 --> 00:03:13,860
Music