
FEATURING EXPERT COMMENTARY

1
00:00:00,010 --> 00:00:03,040
Bell Tone

2
00:00:03,060 --> 00:00:07,090
Hi, this is Alex Young. I'm a heliophysicist

3
00:00:07,110 --> 00:00:11,140
at NASA's Goddard Space Flight Center. And many of you may have seen the

4
00:00:11,160 --> 00:00:15,190
video recently that showed the sun for the past three years

5
00:00:15,210 --> 00:00:19,240
observed by the Solar Dynamics Observatory. I also saw this recently,

6
00:00:19,260 --> 00:00:23,340
thought it was a really cool video and I want to share with you some of the interesting

7
00:00:23,360 --> 00:00:27,400
features I noticed in the video. -MUSIC-

8
00:00:27,420 --> 00:00:31,460
If you see that big black disk that moves over the sun, that's

9
00:00:31,480 --> 00:00:35,540
the moon--what we call a lunar transit. That's when the moon is moving

10
00:00:35,560 --> 00:00:39,600
between the sun and the SDO spacecraft.

11
00:00:39,620 --> 00:00:43,660
It almost looks like a perfect circle, but if you look really

12
00:00:43,680 --> 00:00:47,740
really close on the edge, you see these little tiny humps. Those

13
00:00:47,760 --> 00:00:51,820

are the mountains on the moon. Just an amazing thing you can see with

14
00:00:51,840 --> 00:00:55,940
these incredibly high-resolution cameras. We're looking

15
00:00:55,960 --> 00:01:00,020
at the 171 angstrom wavelength. This is extreme

16
00:01:00,040 --> 00:01:04,160
ultraviolet. And it's showing us the solar atmosphere at about

17
00:01:04,180 --> 00:01:08,180
a million degrees Fahrenheit. And if you look at this image, you can

18
00:01:08,200 --> 00:01:12,210
see all of these bright patches, these are active

19
00:01:12,230 --> 00:01:16,240
regions associated with sunspots. And then you even see

20
00:01:16,260 --> 00:01:20,270
loops. These are huge structures many times the size of

21
00:01:20,290 --> 00:01:24,300
Earth that are magnetic fields holding in

22
00:01:24,320 --> 00:01:28,310
this hot solar plasma. One of the

23
00:01:28,330 --> 00:01:32,340
things that's amazing about this is there's so much stuff going on in this

24
00:01:32,360 --> 00:01:36,360
image as we're looking over time. There's a really big

25
00:01:36,380 --> 00:01:40,390
flash on one side of the sun--that's a solar flare. And in this

26
00:01:40,410 --> 00:01:44,430
case it's the largest solar flare that happened during this particular

27
00:01:44,450 --> 00:01:48,470
solar activity cycle. One of the coolest things that we

28
00:01:48,490 --> 00:01:52,500
can see from this video is the simple fact that the sun

29
00:01:52,520 --> 00:01:56,540
rotates around its axis. The center near the equator

30
00:01:56,560 --> 00:02:00,570
takes about 25 days for it to rotate all the way

31
00:02:00,590 --> 00:02:04,600
around and come back to the same place. Now, I'm pointing this out because

32
00:02:04,620 --> 00:02:08,630
the sun has a special feature, something called differential rotation.

33
00:02:08,650 --> 00:02:12,650
A point on the equator actually moves faster

34
00:02:12,670 --> 00:02:16,670
than a point closer to the north or south pole.

35
00:02:16,690 --> 00:02:20,700
One thing that happens is sometimes the images move, the sun

36
00:02:20,720 --> 00:02:24,740
moves around or even rolls. But that's actually the

37
00:02:24,760 --> 00:02:28,770
spacecraft moving, not the sun. SDO has to

38
00:02:28,790 --> 00:02:32,810

occasionally roll the entire spacecraft in order to

39
00:02:32,830 --> 00:02:36,850
calibrate the cameras and instrumentation on board.

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00:02:36,870 --> 00:02:40,880
If you notice, those bright patches, those active

41
00:02:40,900 --> 00:02:44,930
regions, start off towards the poles

42
00:02:44,950 --> 00:02:48,950
of the sun and as we move in time, they start to

43
00:02:48,970 --> 00:02:52,990
slowly creep towards the equator. This is part of what we call

44
00:02:53,010 --> 00:02:57,040
the solar activity cycle or solar cycle. As we

45
00:02:57,060 --> 00:03:01,080
move from very low activity, with very few sunspots,

46
00:03:01,100 --> 00:03:05,150
to high activity, with a lot of sunspots.

47
00:03:05,170 --> 00:03:09,190
This is something that happens again and again, and it's happened

48
00:03:09,210 --> 00:03:13,230
for millions of years. -MUSIC-

49
00:03:13,250 --> 00:03:17,310
-MUSIC-

50
00:03:17,330 --> 00:03:21,370
And now we can see the sun

51
00:03:21,390 --> 00:03:25,420
in multiple wavelengths of light simultaneously. We see

52
00:03:25,440 --> 00:03:29,470
the visible sun, where you can see the dark sunspots.

53
00:03:29,490 --> 00:03:33,540
And then if you look at the 171 extreme ultraviolet

54
00:03:33,560 --> 00:03:37,600
you see the corresponding bright areas and the magnetic

55
00:03:37,620 --> 00:03:41,710
loops coming from them. If we go to the 193

56
00:03:41,730 --> 00:03:45,790
you see even more structure and you see these dark patches.

57
00:03:45,810 --> 00:03:49,850
And this is where magnetic fields are open out into space

58
00:03:49,870 --> 00:03:53,920
letting out something called the solar wind in these very

59
00:03:53,940 --> 00:03:58,040
fast streams of particles. And then the last one, the red

60
00:03:58,060 --> 00:04:02,130
one, is 304 angstrom, and this is showing us what we

61
00:04:02,150 --> 00:04:06,230
call the chromosphere. And these red areas are often visible

62
00:04:06,250 --> 00:04:10,330
when you see the sun from total solar eclipse.

63
00:04:18,500 --> 00:04:14,480

-MUSIC-

64
00:04:18,520 --> 00:04:22,530
Did you see that little tiny black

65
00:04:22,550 --> 00:04:26,560
dot that's close to the north pole on the sun? That's Venus.

66
00:04:26,580 --> 00:04:30,590
Every hundred years or so, it moves in front of the sun

67
00:04:30,610 --> 00:04:34,630
giving us this rare and amazing astronomical

68
00:04:34,650 --> 00:04:38,660
event. -MUSIC-

69
00:04:50,730 --> 00:04:42,670
-MUSIC-