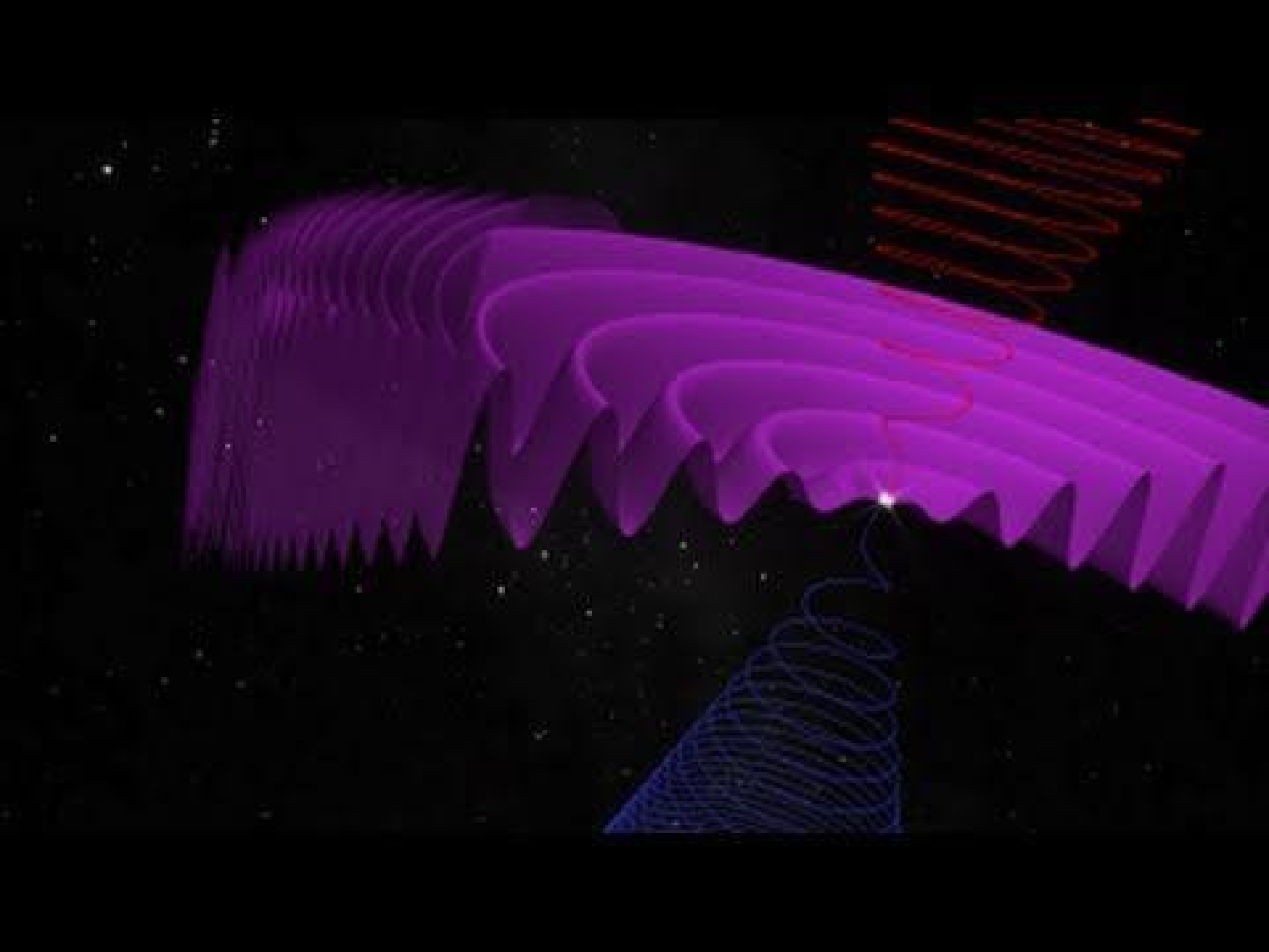

1
00:00:08,310 --> 00:00:04,290
Tone

2
00:00:08,330 --> 00:00:12,380
Music

3
00:00:12,400 --> 00:00:16,400
Narrator: The two Voyager spacecraft have been traveling away

4
00:00:16,420 --> 00:00:20,420
from Earth for more than 33 years and they are finally in the outer edge of the solar

5
00:00:20,440 --> 00:00:24,450
system. This boundary is marked by the outer reaches of the sun's

6
00:00:24,470 --> 00:00:28,470
magnetic field and solar wind, which form an enormous expanse called the heliosphere.

7
00:00:28,490 --> 00:00:32,500
As the solar wind travels out from the sun, it pushes against the galactic

8
00:00:32,520 --> 00:00:36,520
medium and abruptly slows down. This is called the termination shock.

9
00:00:36,540 --> 00:00:40,560
Outside this is the heliosheath, where the solar wind slows to a stop

10
00:00:40,580 --> 00:00:44,590
and the magnetic field is bent back by the ionized interstellar wind.

11
00:00:44,610 --> 00:00:48,600
The sun's magnetic field spins opposite directions

12
00:00:48,620 --> 00:00:52,650
on the north and south poles, creating a sheet where the two spins meet.

13
00:00:52,670 --> 00:00:56,670

This sheet gently ripples as it travels outward and the ripples get bigger

14
00:00:56,690 --> 00:01:00,700
as they go. When this sheet reaches the termination

15
00:01:00,720 --> 00:01:04,720
shock, it starts to compress, like water waves hitting a wall.

16
00:01:04,740 --> 00:01:08,770
The Voyager spacecraft have now found that after the termination shock, these stacked-up

17
00:01:08,790 --> 00:01:12,810
ripples of magnetic field form bubbles, shown here as a computer simulation.

18
00:01:12,830 --> 00:01:16,830
This discovery has prompted a complete

19
00:01:16,850 --> 00:01:20,860
revision of what the heliosheath region looks like. The smooth streamlined look is

20
00:01:20,880 --> 00:01:24,870
gone, replaced with a bubbly, frothy outer layer. This new layer

21
00:01:24,890 --> 00:01:28,890
also changes our understanding of how extremely fast-moving particles called cosmic

22
00:01:28,910 --> 00:01:32,900
rays enter our solar system. When they arrive at the bubble region,

23
00:01:32,920 --> 00:01:36,930
they slowly move from bubble to bubble until they can reach smooth magnetic field lines and

24
00:01:36,950 --> 00:01:40,940
follow them toward the sun. The nature of the bubble region explains

25
00:01:40,960 --> 00:01:44,950
why Voyager II has been seeing variations in the number of energetic particles compared

26
00:01:44,970 --> 00:01:48,960
to Voyager I. Because of its path, Voyager II has been passing

27
00:01:48,980 --> 00:01:52,980
in and out of the bubble region. When it is in the region Voyager II sees

28
00:01:53,000 --> 00:01:56,990
many trapped cosmic rays and electrons. When it is out of the region

29
00:01:57,010 --> 00:02:01,000
the spacecraft sees fewer. Even as the Voyagers answer questions

30
00:02:01,020 --> 00:02:05,010
about our solar system, they raise others. For example, scientists

31
00:02:05,030 --> 00:02:09,010
aren't clear yet how the bubbly heliosheath is linked to the ribbon feature discovered by

32
00:02:09,030 --> 00:02:13,010
IBEX and Cassini. This ribbon shows the emission of energetic particles

33
00:02:13,030 --> 00:02:17,020
and seems to indicate some interaction with interstellar space.

34
00:02:17,040 --> 00:02:21,040
In the meantime, the Voyager spacecraft continue sending back data, and,

35
00:02:21,060 --> 00:02:25,060
after three decades, they still have a unique perspective to offer