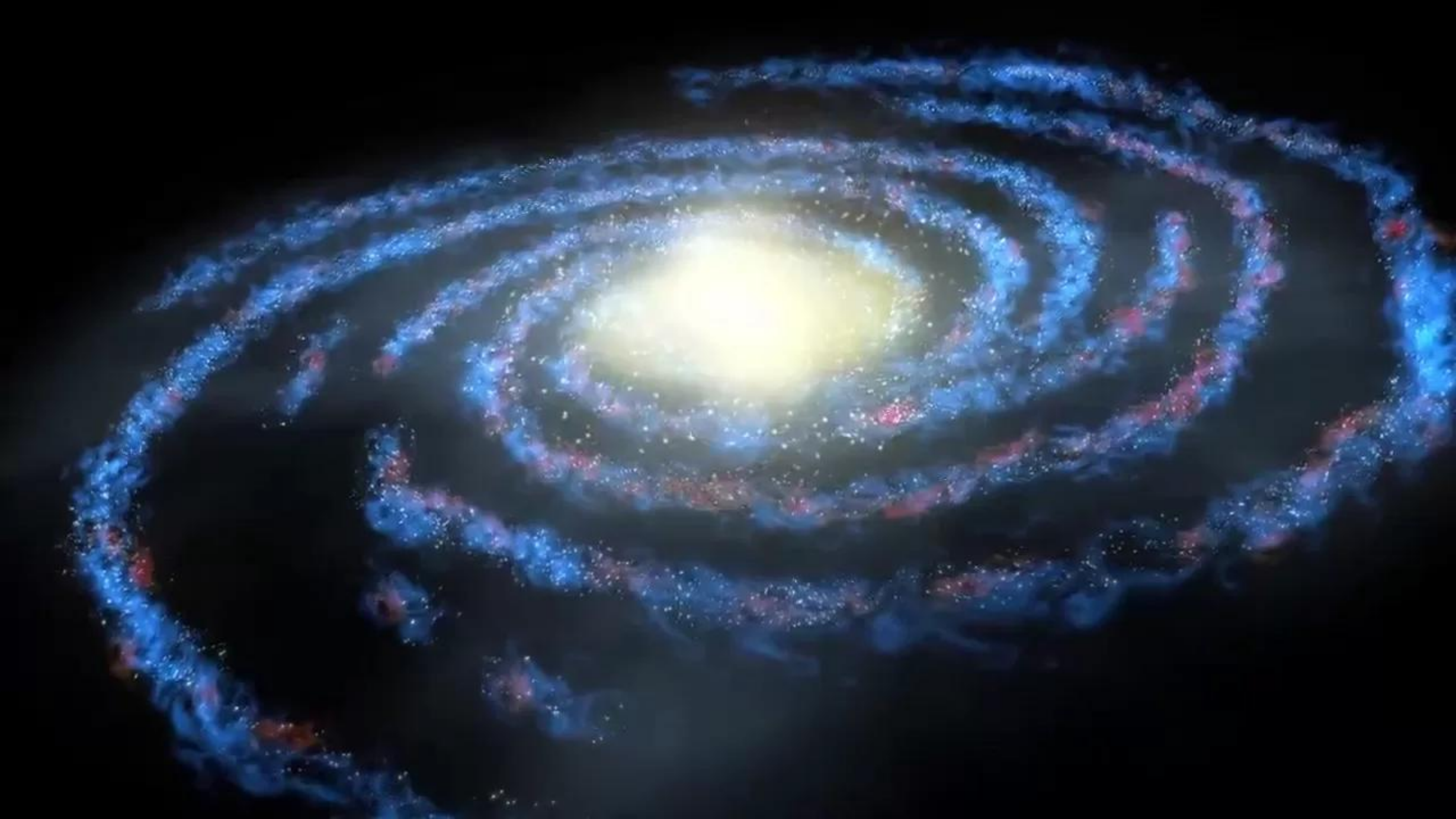

1
00:00:08,060 --> 00:00:04,020
Bell Tone

2
00:00:08,080 --> 00:00:12,140
Music

3
00:00:12,160 --> 00:00:16,180
Although we can't feel it,

4
00:00:16,200 --> 00:00:20,240
our solar system is constantly being changed by a galactic wind.

5
00:00:20,260 --> 00:00:24,310
The wind is composed of gases like hydrogen, helium, oxygen and

6
00:00:24,330 --> 00:00:28,340
neon, which form a very wispy "atmosphere" between stars.

7
00:00:28,360 --> 00:00:32,410
This gas is called the interstellar medium. Like a bicycle

8
00:00:32,430 --> 00:00:36,430
traveling in a crosswind, the wind that the solar system feels is actually a

9
00:00:36,450 --> 00:00:40,470
combination of a solar system's movement relative to the galaxy and the

10
00:00:40,490 --> 00:00:44,480
movement of the interstellar medium itself. The solar wind

11
00:00:44,500 --> 00:00:48,550
pushes out against this galactic wind, forming a bubble called the heliosphere.

12
00:00:48,570 --> 00:00:52,580
The outer boundary is called the heliopause, and is blown

13
00:00:52,600 --> 00:00:56,660

into a teardrop-shape by the galactic wind. IBEX, or the

14
00:00:56,680 --> 00:01:00,750
Interstellar Boundary Explorer is designed to study this region from Earth

15
00:01:00,770 --> 00:01:04,770
orbit and has now made the first direct measurements of hydrogen,

16
00:01:04,790 --> 00:01:08,770
oxygen and neon from outside the solar system.

17
00:01:08,790 --> 00:01:12,820
Many instruments have seen the characteristic spectra of elements outside the solar

18
00:01:12,840 --> 00:01:16,870
system, but IBEX is actually detecting atoms from interstellar

19
00:01:16,890 --> 00:01:20,910
space that punch through the heliopause and strike the spacecraft.

20
00:01:20,930 --> 00:01:24,940
Only some of the atoms that make up the galactic wind can do this.

21
00:01:24,960 --> 00:01:28,990
Much of the galactic wind is made up of

22
00:01:29,010 --> 00:01:33,050
ions, which are atoms with charge due to missing electrons.

23
00:01:33,070 --> 00:01:37,070
the remaining atoms are neutral; they have the same number of electrons and protons.

24
00:01:37,090 --> 00:01:41,110
The ions are deflected by the magnetic field of the sun,

25
00:01:41,130 --> 00:01:45,160
just like the magnetic field of the Earth deflects the solar wind, but the

26
00:01:45,180 --> 00:01:49,190
neutral atoms are unaffected and go straight through.

27
00:01:49,210 --> 00:01:53,220
The measurement of these atoms by IBEX has enabled scientists to get a better

28
00:01:53,240 --> 00:01:57,260
grasp on the environment around our solar system.

29
00:01:57,280 --> 00:02:01,280
The speed of the galactic wind registered around 52,000 miles per hour,

30
00:02:01,300 --> 00:02:05,320
which is about 12% slower than previously thought. At that speed,

31
00:02:05,340 --> 00:02:09,370
it still takes about 30 years for each atom to reach

32
00:02:09,390 --> 00:02:13,380
IBEX from the edge of the solar system. The IBEX measurements

33
00:02:13,400 --> 00:02:17,410
of heavy interstellar atoms, oxygen and neon, show a

34
00:02:17,430 --> 00:02:21,460
difference from the solar system and galaxy as a whole. This puzzle

35
00:02:21,480 --> 00:02:25,480
may mean that the sun has moved out of the region where it formed, or that some

36
00:02:25,500 --> 00:02:29,520
of the oxygen has been captured by dust in interstellar space.

37
00:02:29,540 --> 00:02:33,580
These direct, physical measurements of the universe right on the sun's

38
00:02:33,600 --> 00:02:37,600

doorstep help us understand the history and future of our solar system

39
00:02:37,620 --> 00:02:41,630
and the galaxy. What scientists learn can help protect

40
00:02:41,650 --> 00:02:45,680
human spaceflight and teach us more about our home in the Milky Way.

41
00:02:45,700 --> 00:02:49,700
Music