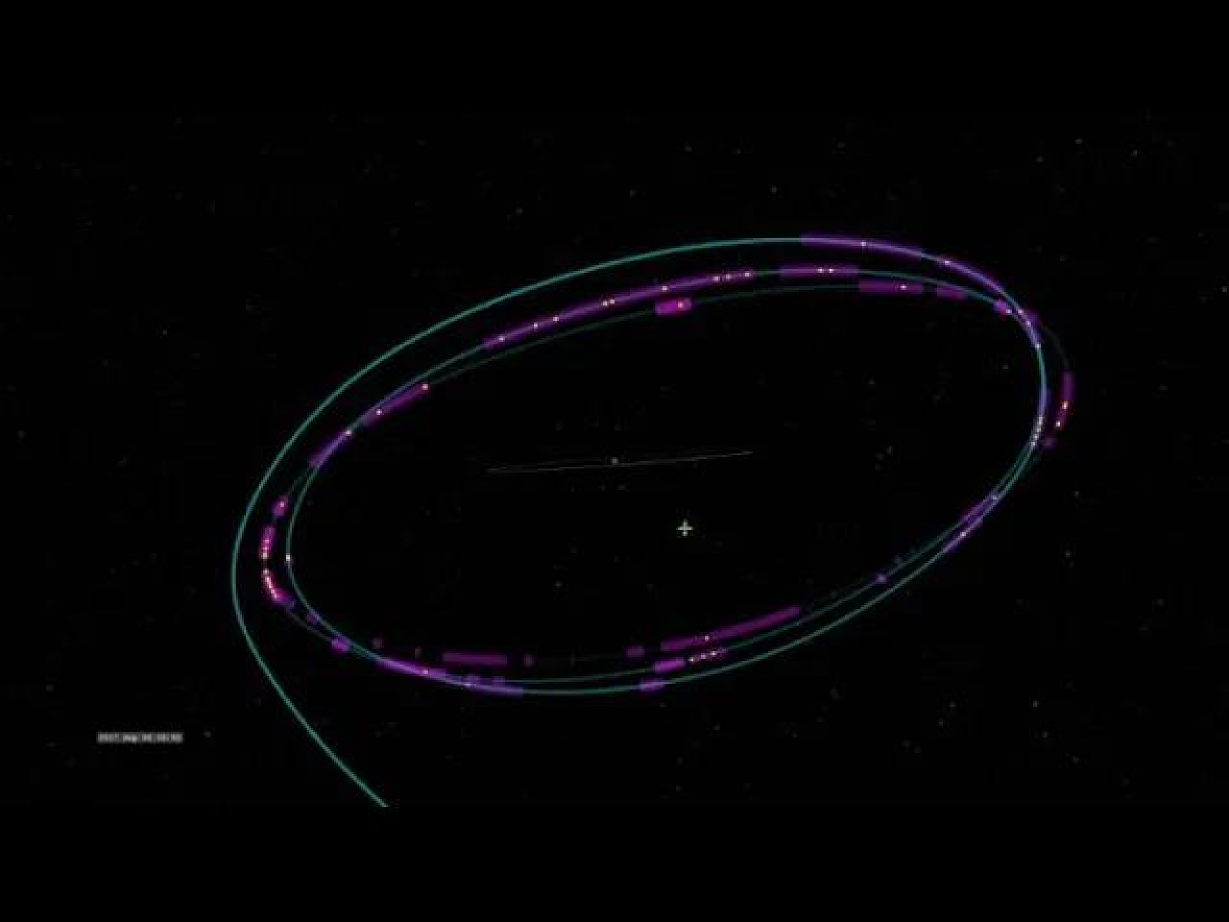

1
00:00:00,000 --> 00:00:03,980
[Music throughout] The solar system is full of rocks,

2
00:00:04,000 --> 00:00:07,980
but not all of them are large.

3
00:00:08,000 --> 00:00:11,980
Dust-size particles shed from comets

4
00:00:12,000 --> 00:00:15,980
and asteroids, and smaller than a single grain of sand, traverse the

5
00:00:16,000 --> 00:00:19,980
solar system at speeds reaching 40,000 miles an hour.

6
00:00:20,000 --> 00:00:23,980
Our best knowledge of these tiniest meteoroids comes from measurements made near Earth.

7
00:00:24,000 --> 00:00:27,980
But a clever use of data from the LISA Pathfinder mission has

8
00:00:28,000 --> 00:00:31,980
tallied these particles nearly a million miles away.

9
00:00:32,000 --> 00:00:35,980
Launched in 2015 and retired in 2017, LISA

10
00:00:36,000 --> 00:00:39,980
Pathfinder is an ESA-led mission that demonstrated the technology needed

11
00:00:40,000 --> 00:00:43,980
to built a future space-based gravitational wave observatory – a tool

12
00:00:44,000 --> 00:00:47,980
for detecting ripples in space-time produced by, among other

13
00:00:48,000 --> 00:00:51,980

things, merging black holes.

14
00:00:52,000 --> 00:00:55,980
LISA Pathfinder was a resounding success, demonstrating it could keep its

15
00:00:56,000 --> 00:00:59,980
instruments steadier than any mission previously flown.

16
00:01:00,000 --> 00:01:03,980
It reduced unwanted forces on its instruments to less than a millionth of a billionth

17
00:01:04,000 --> 00:01:07,980
of the gravity felt on Earth. To do this,

18
00:01:08,000 --> 00:01:11,980
LISA Pathfinder had to isolate its instruments from environmental disturbances,

19
00:01:12,000 --> 00:01:15,980
including occasional micrometeoroid impacts.

20
00:01:16,000 --> 00:01:19,980
Each strike moved the spacecraft slightly, and it reacted immediately

21
00:01:20,000 --> 00:01:23,980
by firing small thrusters. The science team found

22
00:01:24,000 --> 00:01:27,980
and characterized 54 impacts over the mission’s duration, shown

23
00:01:28,000 --> 00:01:31,980
here as yellow dots. LISA Pathfinder

24
00:01:32,000 --> 00:01:35,980
did its work while orbiting Earth-Sun L1, a gravitational

25
00:01:36,000 --> 00:01:39,980
balance point about a million miles toward the Sun. This is

26
00:01:40,000 --> 00:01:43,980
essentially unexplored territory for understanding the solar system’s dust distribution.

27
00:01:44,000 --> 00:01:47,980
The science team was able to use data in between

28
00:01:48,000 --> 00:01:51,980
various other tests to search for dust impacts on the spacecraft,

29
00:01:52,000 --> 00:01:55,980
seen here as purple regions.

30
00:01:56,000 --> 00:01:59,980
The findings were broadly consistent with existing ideas of what generates

31
00:02:00,000 --> 00:02:03,980
micrometeoroids found near Earth. These models predominantly favor nearby

32
00:02:04,000 --> 00:02:07,980
Jupiter-family comets – like 9P/Tempel 1,

33
00:02:08,000 --> 00:02:11,980
103P/Hartley, and 67P/Churyumov-Gerasimenko –

34
00:02:12,000 --> 00:02:15,980
as the main dust makers, with additional contributions

35
00:02:16,000 --> 00:02:19,980
from comets with longer periods, like Halley’s Comet.

36
00:02:20,000 --> 00:02:23,980
Improving our dust knowledge will help future missions assess

37
00:02:24,000 --> 00:02:27,980
potential hazards for spacecraft operating in the inner solar system.

38
00:02:28,000 --> 00:02:31,980

It will also help us better understand the dust environments around other stars,

39
00:02:32,000 --> 00:02:35,980
which can complicate searching for planets around them. And the same

40
00:02:36,000 --> 00:02:39,980
technique can be used on other precision-measurement missions.

41
00:02:40,000 --> 00:02:43,980
We’ll learn a bit more about the solar system each time one of these spacecraft is

42
00:02:44,000 --> 00:02:47,980
struck by a microscopic crumb.

43
00:02:48,000 --> 00:02:51,980
[Additional animations courtesy of ESA, Max Planck Institute for Gravitational Physics and Milde Marketing]