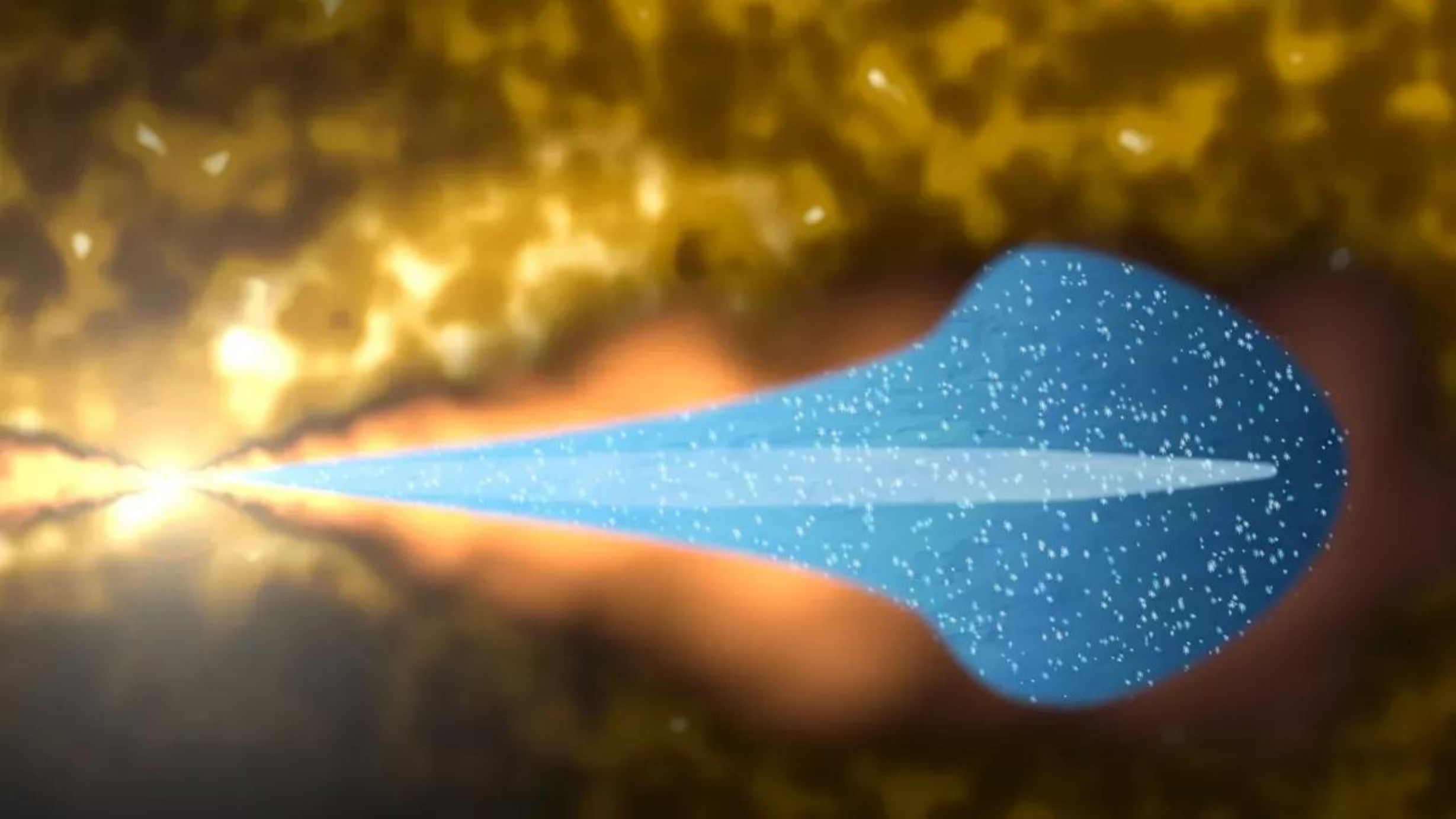

1
00:00:00,020 --> 00:00:04,060
Narrator: Most telescopes are either firmly planted

2
00:00:04,060 --> 00:00:08,090
on the Earth, or floating in space. There is

3
00:00:08,090 --> 00:00:12,110
one NASA mission, however, that flies in between.

4
00:00:12,110 --> 00:00:16,140
SOFIA, the Stratospheric Observatory for Infrared Astronomy,

5
00:00:16,140 --> 00:00:20,190
is an infrared telescope built into a

6
00:00:20,190 --> 00:00:24,190
747SP jet airliner. It enables research not possible

7
00:00:24,190 --> 00:00:28,200
with any other telescope. Flying at

8
00:00:28,200 --> 00:00:32,220
39 to 45 thousand feet, SOFIA is above

9
00:00:32,220 --> 00:00:36,260
99 percent of the water vapor that blocks infrared light from space,

10
00:00:36,260 --> 00:00:40,280
so its view is nearly equal to a satellite's. But unlike

11
00:00:40,280 --> 00:00:44,340
a satellite, its instruments can be upgraded and replaced, just like

12
00:00:44,340 --> 00:00:48,370
a Earth-based observatory. And, with each upgrade,

13
00:00:48,370 --> 00:00:52,410

SOFIA's powers increase. Currently, its sensitivity

14
00:00:52,410 --> 00:00:56,430
and resolution are similar to some infrared satellites. However,

15
00:00:56,430 --> 00:01:00,480
a new instrument is about help astronomers reach SOFIA's

16
00:01:00,480 --> 00:01:04,490
maximum sensitivity at far infrared wavelengths between

17
00:01:04,490 --> 00:01:08,530
25 and 122 microns. Called HIRMES,

18
00:01:08,530 --> 00:01:12,570
the High Resolution Mid-InfraRed Spectrometer, is not

19
00:01:12,570 --> 00:01:16,580
designed to take pictures, but rather make incredibly precise measurements

20
00:01:16,580 --> 00:01:20,610
of specific far infrared wavelengths emitted by oxygen,

21
00:01:20,610 --> 00:01:24,680
water and hydrogen. Seeing how these atoms and molecules

22
00:01:24,680 --> 00:01:28,720
are distributed around a young star is crucial for

23
00:01:28,720 --> 00:01:32,740
astronomers to better understand how planets form.

24
00:01:32,740 --> 00:01:36,770
HIRMES is being built by a team led by Harvey Moseley at

25
00:01:36,770 --> 00:01:40,810
NASA's Goddard Space Flight Center. Goddard is one part

26
00:01:40,810 --> 00:01:44,830
of the large, collaborative effort that makes SOFIA possible.

27
00:01:44,830 --> 00:01:48,900
NASA's Ames Research Center manages the program,

28
00:01:48,900 --> 00:01:52,920
the Armstrong Flight Research Center maintains and operates the aircraft,

29
00:01:52,920 --> 00:01:56,930
the German Aerospace Center maintains the telescope, and many other

30
00:01:56,930 --> 00:02:00,980
institutions and organizations contribute their expertise and instruments.

31
00:02:00,980 --> 00:02:05,020
HIRMES will observe light with wavelengths

32
00:02:05,020 --> 00:02:09,090
30 to 160 times longer than the reddest red humans

33
00:02:09,090 --> 00:02:13,130
can see. To do this, the instruments

34
00:02:13,130 --> 00:02:17,170
detectors must be made extremely cold, so their own heat doesn't

35
00:02:17,170 --> 00:02:21,180
overwhelm the infrared light of the objects they're observing.

36
00:02:21,180 --> 00:02:25,200
Because SOFIA lands after each observation period,

37
00:02:25,200 --> 00:02:29,250
its coolant can be refreshed, allowing HIRMES to operate at less than

38
00:02:29,250 --> 00:02:33,260

a degree above absolute zero. At this temperature,

39
00:02:33,260 --> 00:02:37,290
even slight movements can generate unwanted heat.

40
00:02:37,290 --> 00:02:41,350
Vibration is a part of any airplane flight, so SOFIA

41
00:02:41,350 --> 00:02:45,370
has a complex system to isolate it, eliminating any potential

42
00:02:45,370 --> 00:02:49,380
problems from heating, and preventing blurry images at the same time.

43
00:02:49,380 --> 00:02:53,430
By looking at stars with protoplanetary disks,

44
00:02:53,430 --> 00:02:57,450
HIRMES will see far infrared light marking the presence

45
00:02:57,450 --> 00:03:01,500
of neutral oxygen atoms, water, hydrogen

46
00:03:01,500 --> 00:03:05,550
and other molecules. Because water vapor and icy particles

47
00:03:05,550 --> 00:03:09,570
emit different wavelengths, researchers can locate

48
00:03:09,570 --> 00:03:13,580
where the water vapor transitions to ice in protoplanetary disks.

49
00:03:13,580 --> 00:03:17,610
These transition regions have not been well explored

50
00:03:17,610 --> 00:03:21,630
in young planetary systems because ice emissions are difficult

51
00:03:21,630 --> 00:03:25,690
to detect. Finding ice particles is one of HIRMES's

52
00:03:25,690 --> 00:03:29,740
key missions. Putting all these observations together

53
00:03:29,740 --> 00:03:33,760
will help scientists better understand how water vapor, ice,

54
00:03:33,760 --> 00:03:37,790
and oxygen combine at different times during planet formation.

55
00:03:37,790 --> 00:03:41,840
This, in turn, will help us better predict exoplanet

56
00:03:41,840 --> 00:03:45,870
composition and give us clues as to which distant

57
00:03:45,870 --> 00:03:49,890
planets are most similar to Earth.

58
00:03:57,910 --> 00:03:53,900
■Music■