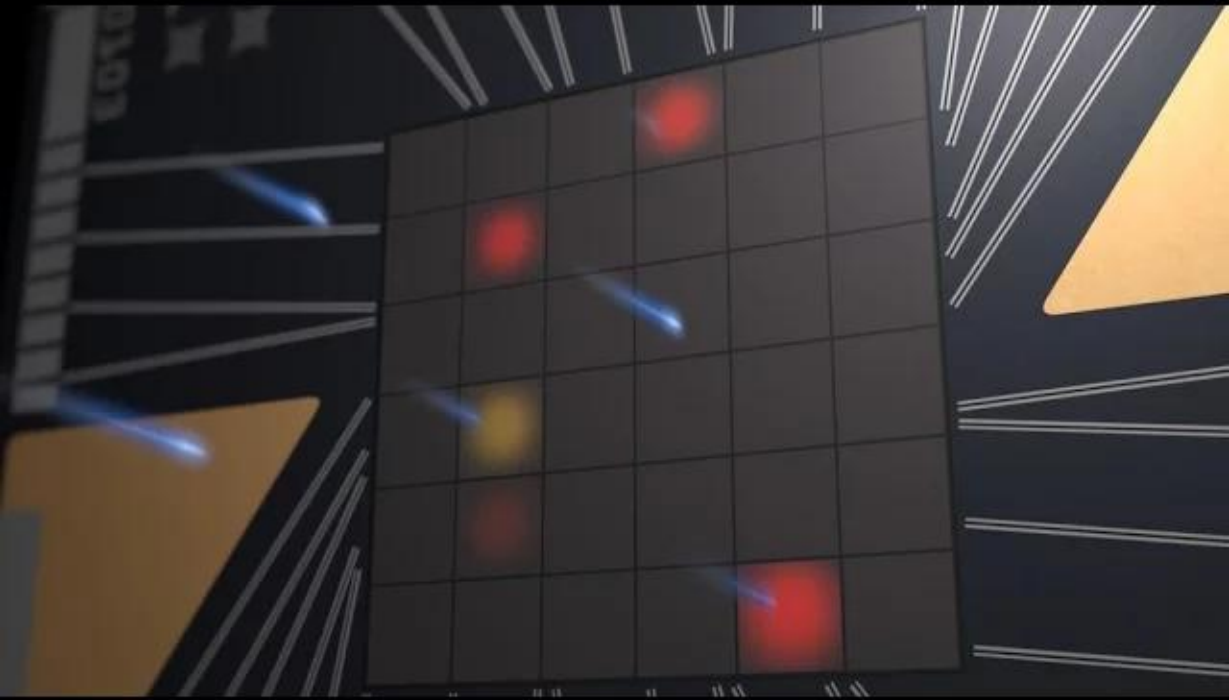

1
00:00:00,010 --> 00:00:04,020
(rocket launch noise)

2
00:00:04,020 --> 00:00:08,030
Lift off.

3
00:00:08,030 --> 00:00:12,070
With the successful launch of Japans Hitomi

4
00:00:12,070 --> 00:00:16,120
satellite. X-ray astronomers anticipated a host of scientific

5
00:00:16,120 --> 00:00:20,150
breakthroughs. Tragically Hitomi broke apart

6
00:00:20,150 --> 00:00:24,180
just five weeks after launch. The mission ending almost before it could

7
00:00:24,180 --> 00:00:28,190
begin, almost because an

8
00:00:28,190 --> 00:00:32,190
advanced instrument called the Soft Xray Spectrometer (SXS) returned early

9
00:00:32,190 --> 00:00:36,200
results that will be studied for years to come. Developed and

10
00:00:36,200 --> 00:00:40,200
built by Goddard scientists working closely with colleagues from several institutions

11
00:00:40,200 --> 00:00:44,210
in Japan. Hitomi's Soft X-ray Spectrometer proved its

12
00:00:44,210 --> 00:00:48,230
ability to separate X-ray colors with unprecedented detail.

13
00:00:48,230 --> 00:00:52,240

Astronomers typically learn about the composition, temperature, and motions of

14
00:00:52,240 --> 00:00:56,250
cosmic sources by spreading light into a rainbow-like spectrum.

15
00:00:56,250 --> 00:01:00,250
Hitomi's Soft X-ray Spectrometer works differently.

16
00:01:00,250 --> 00:01:04,260
It used a microcalorimeter to measure the minute about of heat delivered when

17
00:01:04,260 --> 00:01:08,270
individual X-ray photons struck its 35 pixel detector

18
00:01:08,270 --> 00:01:12,280
array. The results are simply amazing.

19
00:01:12,280 --> 00:01:16,280
During the instruments check out period astronomers targeted

20
00:01:16,280 --> 00:01:20,290
NGC 1275, a galaxy powered by a supermassive black hole.

21
00:01:20,290 --> 00:01:24,290
It resides at the heart of the Perseus galaxy cluster.

22
00:01:24,290 --> 00:01:28,300
A collection of thousands of galaxies immersed in vast cloud of

23
00:01:28,300 --> 00:01:32,300
superheated gas. This multimillion degree gas

24
00:01:32,300 --> 00:01:36,310
makes ths Perseus galaxy cluster the brightest in the sky when seen in X-rays

25
00:01:36,310 --> 00:01:40,320
but until now details about the motion of this gas were out of

26
00:01:40,320 --> 00:01:44,320
reach. Here's the best previous spectrum of the cluster

27
00:01:44,320 --> 00:01:48,330
from Japan's Suzaku mission. And here's what Hitomi saw,

28
00:01:48,330 --> 00:01:52,340
a landscape of X-ray peaks and valleys corresponding

29
00:01:52,340 --> 00:01:56,340
to emissions from various chemical elements, particularly iron and nickel.

30
00:01:56,340 --> 00:02:00,350
These elements forged in massive stars were

31
00:02:00,350 --> 00:02:04,380
distributed by billions of supernovae explosions throughout the clusters history.

32
00:02:04,380 --> 00:02:08,390
The spectrum has thirty times the resolution of the one

33
00:02:08,390 --> 00:02:12,390
captured by Suzaku. This information has, for the first time,

34
00:02:12,390 --> 00:02:16,400
allowed scientist's to map how X-ray emitting gas moves in a

35
00:02:16,400 --> 00:02:20,430
cluster of galaxies. One surprise, the gas is

36
00:02:20,430 --> 00:02:24,430
moving hundreds of thousands of miles an hour toward and away from us.

37
00:02:24,430 --> 00:02:28,440
This is actually surprisingly slow, when you consider that the gas is

38
00:02:28,440 --> 00:02:32,450

continually stirred by bubbles blown out from the active galaxy.

39
00:02:32,450 --> 00:02:36,450
The spectrum also reveals contradictions with current models of how hot plasma

40
00:02:36,450 --> 00:02:40,460
emits X-rays, that astronomers will work to resolve.

41
00:02:40,460 --> 00:02:44,470
Although its mission was cut short, Hitomi's Soft X-ray Spectrometer (SXS)

42
00:02:44,470 --> 00:02:48,480
proved to be the technological marvel its designers expected.

43
00:02:48,480 --> 00:02:52,490
It will lead to a new generation of instruments, capable of distinguishing tens of

44
00:02:52,490 --> 00:02:56,510
thousands of X-ray colors while also capturing sharp images,

45
00:02:56,510 --> 00:03:00,510
Greatly advancing our understanding of the X-ray universe.

46
00:03:12,540 --> 00:03:04,520
(music)