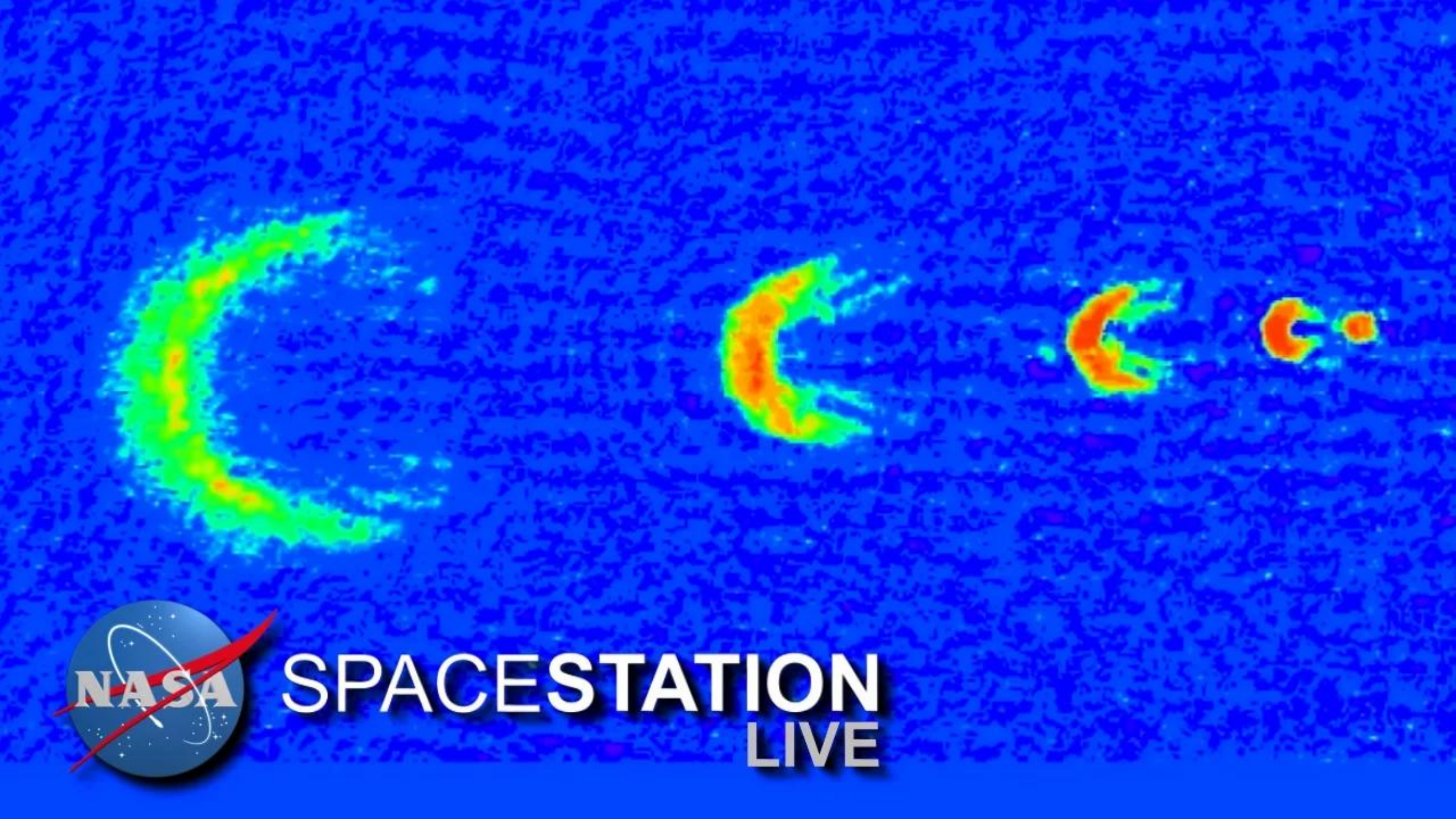
NASA
SPACESTATION
LIVE

1
00:00:08,390 --> 00:00:07,190
we are a facility which is going to go

2
00:00:10,790 --> 00:00:08,400
inside of the international space

3
00:00:12,709 --> 00:00:10,800
station as an express rack payload and

4
00:00:14,709 --> 00:00:12,719
it is a fundamental physics facility

5
00:00:15,829 --> 00:00:14,719
which will allow scientists to perform

6
00:00:17,750 --> 00:00:15,839
research on something called

7
00:00:19,189 --> 00:00:17,760
bose-einstein condensates which is

8
00:00:20,310 --> 00:00:19,199
another state of matter where we get

9
00:00:23,029 --> 00:00:20,320
down to temperatures which are

10
00:00:25,189 --> 00:00:23,039
incredibly cold meaning 100 times 10 to

11
00:00:26,710 --> 00:00:25,199
the minus 12 kelvin which is on the

12
00:00:28,710 --> 00:00:26,720
order of a million times colder than

13
00:00:30,150 --> 00:00:28,720

even the temperature of space how in the

14
00:00:31,990 --> 00:00:30,160
world did we come up with this idea that

15
00:00:34,229 --> 00:00:32,000
we needed this

16
00:00:35,670 --> 00:00:34,239
so it is a science experiment and

17
00:00:37,510 --> 00:00:35,680
condensed matter physics is one of the

18
00:00:40,069 --> 00:00:37,520
most important areas of physics under

19
00:00:41,990 --> 00:00:40,079
research today and we're able to create

20
00:00:43,750 --> 00:00:42,000
these bose einstein condensates using a

21
00:00:45,110 --> 00:00:43,760
technique called laser cooling and when

22
00:00:46,709 --> 00:00:45,120
you use this technique called laser

23
00:00:47,830 --> 00:00:46,719
cooling in a microgravity environment

24
00:00:49,590 --> 00:00:47,840
which you get on the space station you

25
00:00:51,110 --> 00:00:49,600
can get to much colder temperatures and

26
00:00:52,310 --> 00:00:51,120
so basically we want to see what happens

27
00:00:53,670 --> 00:00:52,320
when we get matter down to these

28
00:00:55,510 --> 00:00:53,680
temperatures because they actually start

29
00:00:57,110 --> 00:00:55,520
instead of behaving like particles or

30
00:00:59,430 --> 00:00:57,120
billiard balls matter actually behaves

31
00:01:01,430 --> 00:00:59,440
as waves what does this facility look

32
00:01:03,029 --> 00:01:01,440
like you said it goes to an express rack

33
00:01:06,070 --> 00:01:03,039
yes it goes inside of an express rack on

34
00:01:08,469 --> 00:01:06,080
the space station and it's about um i

35
00:01:10,390 --> 00:01:08,479
would say about the size of two filing

36
00:01:12,630 --> 00:01:10,400
cabinets in width and about a filing

37
00:01:14,870 --> 00:01:12,640
cabinet in depth and it's a box and

38
00:01:17,190 --> 00:01:14,880

inside of the box we have all of our

39
00:01:18,469 --> 00:01:17,200
electronics and our lasers and our

40
00:01:19,830 --> 00:01:18,479
physics package which is actually the

41
00:01:21,830 --> 00:01:19,840
heart of the instrument so from the

42
00:01:23,350 --> 00:01:21,840
outside from what the astronauts can see

43
00:01:24,950 --> 00:01:23,360
it looks like a box from the inside it's

44
00:01:27,510 --> 00:01:24,960
a very sophisticated laser

45
00:01:29,749 --> 00:01:27,520
optomechanical system

46
00:01:32,149 --> 00:01:29,759
laser optics has become quite a

47
00:01:34,870 --> 00:01:32,159
quite a hot topic a hotbed on space

48
00:01:36,069 --> 00:01:34,880
station right i think so yeah and so in

49
00:01:38,390 --> 00:01:36,079
particular this will be the first

50
00:01:39,990 --> 00:01:38,400
demonstration of laser cooling which has

51
00:01:42,630 --> 00:01:40,000
a whole bunch of technology applications

52
00:01:43,910 --> 00:01:42,640
as well so not hot but cold yes so it's

53
00:01:45,429 --> 00:01:43,920
a little bit counterintuitive where you

54
00:01:47,109 --> 00:01:45,439
can actually use lasers to cool

55
00:01:49,030 --> 00:01:47,119
something down and what you're actually

56
00:01:50,789 --> 00:01:49,040
doing is you're using the momentum of

57
00:01:53,190 --> 00:01:50,799
photons to push on atoms which are

58
00:01:54,950 --> 00:01:53,200
coming towards it we are pretty much

59
00:01:56,630 --> 00:01:54,960
autonomous in the sense that we're

60
00:01:59,190 --> 00:01:56,640
controlled from the ground the crew will

61
00:02:00,389 --> 00:01:59,200
have to install the experiment and over

62
00:02:02,069 --> 00:02:00,399
time there may be parts of the

63
00:02:03,429 --> 00:02:02,079

experiment that need to be repaired or

64
00:02:04,950 --> 00:02:03,439
upgraded and the crew will do that as

65
00:02:06,789 --> 00:02:04,960
well so this experiment is designed to

66
00:02:08,869 --> 00:02:06,799
be modular but in terms of nominal

67
00:02:10,710 --> 00:02:08,879
operations it's all operated remotely

68
00:02:12,309 --> 00:02:10,720
from jpl and we specifically operate

69
00:02:14,710 --> 00:02:12,319
during the crew sleep period because our

70
00:02:17,510 --> 00:02:14,720
instrument is sensitive to vibrations

71
00:02:19,110 --> 00:02:17,520
isis will become the coldest spot in the

72
00:02:21,030 --> 00:02:19,120
universe

73
00:02:23,030 --> 00:02:21,040
through this experiment

74
00:02:24,309 --> 00:02:23,040
we will also

75
00:02:27,110 --> 00:02:24,319
observe

76
00:02:29,350 --> 00:02:27,120
over an extended period of time and we

77
00:02:30,710 --> 00:02:29,360
really don't know what to expect we have

78
00:02:32,630 --> 00:02:30,720
some

79
00:02:34,470 --> 00:02:32,640
assumptions so

80
00:02:37,509 --> 00:02:34,480
what really makes it interesting about

81
00:02:39,750 --> 00:02:37,519
cal is this element of the unknown of

82
00:02:41,830 --> 00:02:39,760
the discovery of the

83
00:02:44,070 --> 00:02:41,840
future

84
00:02:46,550 --> 00:02:44,080
exploration of

85
00:02:47,910 --> 00:02:46,560
a region which we don't know

86
00:02:49,509 --> 00:02:47,920
what we

87
00:02:52,869 --> 00:02:49,519
would expect and it's interesting to see

88
00:02:54,390 --> 00:02:52,879

it started in 1920s by with einstein and

89
00:02:57,750 --> 00:02:54,400
cal

90
00:02:58,869 --> 00:02:57,760
only through iss will will enable us to

91
00:03:01,910 --> 00:02:58,879
uncover

92
00:03:05,509 --> 00:03:01,920
this unknown so we were all excited

93
00:03:06,869 --> 00:03:05,519
about what cal and iss combine will

94
00:03:08,630 --> 00:03:06,879
provide us

95
00:03:11,910 --> 00:03:08,640
so the cold atom lab is just the first

96
00:03:13,589 --> 00:03:11,920
step that's correct because we feel

97
00:03:15,190 --> 00:03:13,599
what

98
00:03:20,470 --> 00:03:15,200
laser has

99
00:03:25,670 --> 00:03:23,430
all aspects of physics and daily lives

100
00:03:26,550 --> 00:03:25,680
what laser did to physics

101
00:03:33,350 --> 00:03:26,560
and

102
00:03:36,149 --> 00:03:33,360
believe that

103
00:03:39,190 --> 00:03:36,159
by cooling atoms to this very

104
00:03:41,670 --> 00:03:39,200
near absolute uh zero temperature

105
00:03:46,229 --> 00:03:41,680
we'll also open up an array of

106
00:03:47,430 --> 00:03:46,239
technologies from super uh computers to

107
00:03:49,990 --> 00:03:47,440
you know