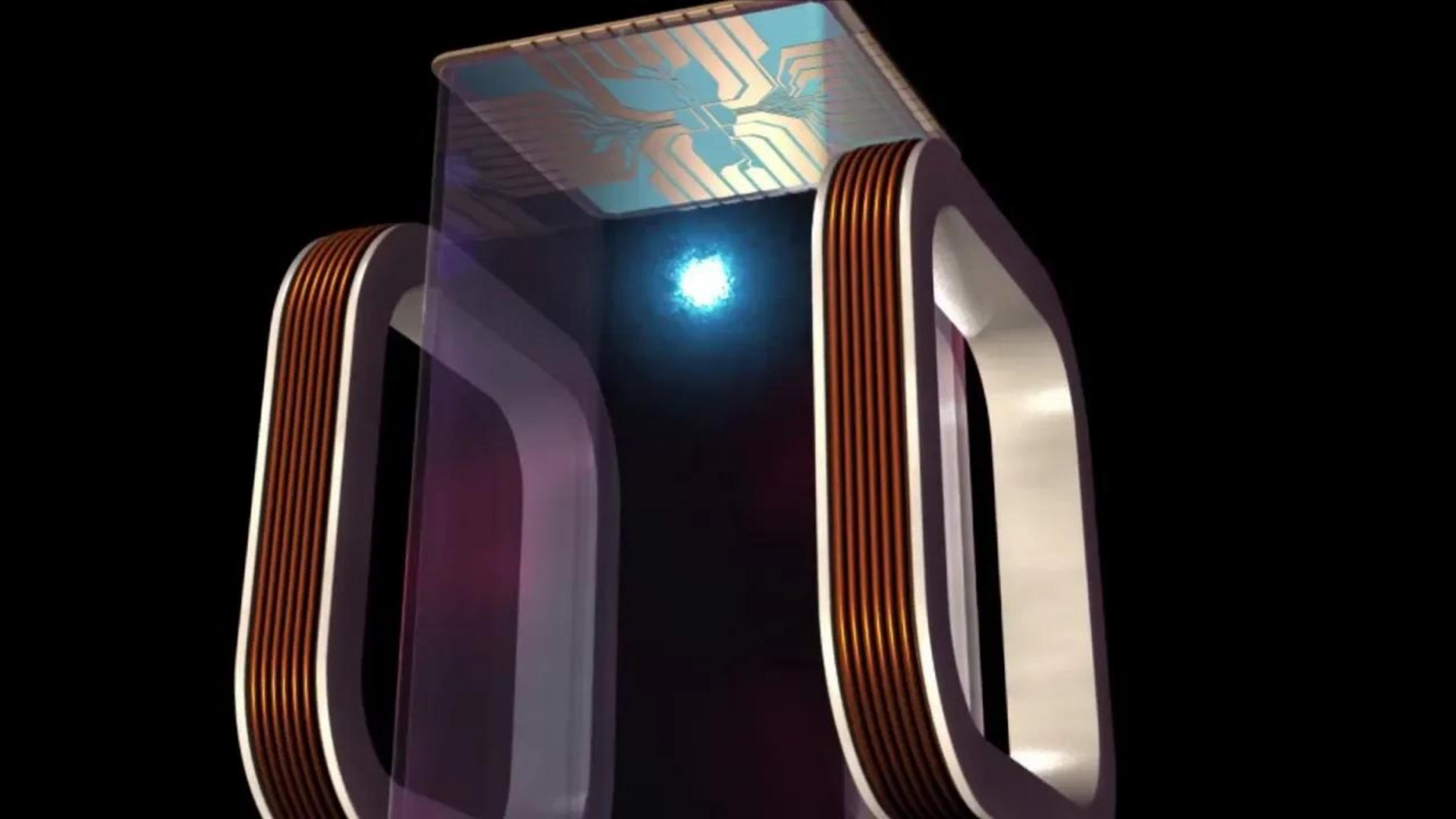

1
00:00:00,499 --> 00:00:02,468
[ ■ ]

2
00:00:07,106 --> 00:00:12,045
Kamal Oudrhiri: Roughly 68% of
the universe is dark energy.

3
00:00:12,078 --> 00:00:16,149
About 27% makes up dark matter.

4
00:00:16,182 --> 00:00:20,153
So all we know is less than 5%.

5
00:00:20,186 --> 00:00:24,824
95% of what surrounds us
continues to be a mystery.

6
00:00:27,159 --> 00:00:29,062
Robert Shotwell: One of the
ways that we get smarter

7
00:00:29,095 --> 00:00:31,264
is to try to build
better instruments.

8
00:00:31,297 --> 00:00:33,666
And the Cold Atom Laboratory
is one of those instruments.

9
00:00:33,699 --> 00:00:36,335
So the Cold Atom Laboratory's
intended to provide one of

10
00:00:36,368 --> 00:00:39,572
the most sensitive instruments
mankind's ever built.

11
00:00:39,605 --> 00:00:43,109
That instrument is based around

a Bose-Einstein condensate.

12
00:00:44,310 --> 00:00:46,446
Jim Kohel: A Bose-Einstein
condensate is

13
00:00:46,479 --> 00:00:49,482
a unique quantum
state of matter,

14
00:00:49,515 --> 00:00:52,819
which we can only obtain at
the coldest temperatures

15
00:00:52,852 --> 00:00:54,353
and very high densities.

16
00:00:54,386 --> 00:00:59,859
It is actually a macroscopic
ensemble of atoms

17
00:00:59,892 --> 00:01:02,728
that you can view with a camera

18
00:01:02,761 --> 00:01:08,434
and these wispy clouds of atoms
behave in very strange ways.

19
00:01:08,467 --> 00:01:10,269
They're no longer
distinguishable as

20
00:01:10,302 --> 00:01:12,505
an individual particle.

21
00:01:12,538 --> 00:01:15,241
You really have to
describe it more like

22

00:01:15,274 --> 00:01:18,611
atoms acting collectively
as a wave.

23
00:01:21,614 --> 00:01:22,515
Shotwell: So the quest
to getting

24
00:01:22,548 --> 00:01:24,350
colder and colder temperatures,

25
00:01:24,383 --> 00:01:27,553
really that's to get a higher
fidelity instrument.

26
00:01:27,586 --> 00:01:30,523
Basically, the colder
you can get matter

27
00:01:30,556 --> 00:01:32,859
and reduce the amount
of vibrations

28
00:01:32,892 --> 00:01:34,527
and other things that
they normally do,

29
00:01:34,560 --> 00:01:36,729
you can start using them as more
sensitive instruments

30
00:01:36,762 --> 00:01:39,165
to test other theories and
understand physics

31
00:01:39,198 --> 00:01:40,800
at a more fundamental level.

32
00:01:42,034 --> 00:01:44,303
Rob Thompson: It's not just

lower temperatures, but it's

33
00:01:44,336 --> 00:01:46,572
also the fact that we
want to study atoms.

34
00:01:46,605 --> 00:01:49,475
And we want to look at them for
really long periods of time.

35
00:01:49,508 --> 00:01:53,146
And that is really only
possible in microgravity.

36
00:01:54,447 --> 00:01:56,682
David Aveline: On the Earth we
have a limited amount of time

37
00:01:56,715 --> 00:01:59,685
once you let go of the atoms or
weaken them that they

38
00:01:59,718 --> 00:02:03,289
will fall out of your trap and
run into the, you know,

39
00:02:03,322 --> 00:02:04,891
limits of your experiment.

40
00:02:04,924 --> 00:02:07,793
So, when we get to a
microgravity environment

41
00:02:07,826 --> 00:02:11,764
we can get to these long
interrogation times in space.

42
00:02:13,199 --> 00:02:14,600
Shotwell: Once we get on orbit

43
00:02:14,633 --> 00:02:16,202
and into a microgravity
environment,

44
00:02:16,235 --> 00:02:17,270
we'll be able to achieve

45
00:02:17,303 --> 00:02:20,873
temperatures never physically
manifested before.

46
00:02:20,906 --> 00:02:23,809
So we will make the coldest spot
in the universe

47
00:02:23,842 --> 00:02:26,746
by creating Bose-Einstein
condensates

48
00:02:26,779 --> 00:02:30,216
and then further cooling them,
even beyond the B-EC realm.

49
00:02:31,117 --> 00:02:32,952
Oudrhiri: The
ultra-sensitive atoms

50
00:02:32,985 --> 00:02:35,254
in the Cold Atom Laboratory

51
00:02:35,287 --> 00:02:38,591
have the potential to
unlock many mysteries

52
00:02:38,624 --> 00:02:42,528
beyond the frontiers
of the known universe.

53
00:02:42,561 --> 00:02:44,530

NASA Jet Propulsion Laboratory