



1
00:00:04,120 --> 00:00:08,160
Narrator: This is the universe as we

2
00:00:08,180 --> 00:00:12,260
imagine it...objects floating quietly in space.

3
00:00:12,280 --> 00:00:16,440
This is the universe as scientists think it actually behaves.

4
00:00:16,460 --> 00:00:20,620
Objects in space affected ever so slightly by gravitational waves.

5
00:00:20,640 --> 00:00:24,800
Ripples in space-time caused for example by

6
00:00:24,820 --> 00:00:28,990
the merger of two black holes. The trick

7
00:00:29,010 --> 00:00:33,180
is to actually measure these gravitational ripples and to do that

8
00:00:33,200 --> 00:00:37,360
you need a remarkably precise measuring instrument.

9
00:00:37,380 --> 00:00:41,440
You need an atom interferometer. Babak Saif: Gravitational wave detection,

10
00:00:41,460 --> 00:00:45,580
this new carrier would allow us to go

11
00:00:45,600 --> 00:00:49,740
way further back in time and we're looking at the Big Bang,

12
00:00:49,760 --> 00:00:53,880
and it really increases our knowledge of cosmology. Narrator: Theory says these

13
00:00:53,900 --> 00:00:58,070

ripples form when big objects like galaxies and stars move in the

14

00:00:58,090 --> 00:01:02,260

universe. Long since predicted by Einstein's general theory of

15

00:01:02,280 --> 00:01:06,440

relativity, they've never been directly detected. Optical

16

00:01:06,460 --> 00:01:10,520

interferometry--that is visible light measurements--could do the job, but

17

00:01:10,540 --> 00:01:14,730

previous mission concepts were very expensive. A ground

18

00:01:14,750 --> 00:01:18,920

based observatory called advanced LIGO may one day detect

19

00:01:18,940 --> 00:01:23,150

gravity waves. So why atom interferometry?

20

00:01:23,170 --> 00:01:27,350

Mind-boggling precision, by blasting rubidium atoms

21

00:01:27,370 --> 00:01:31,540

with carefully calibrated lasers to super-chill them right above absolute

22

00:01:31,560 --> 00:01:35,720

zero, a change in position of so much as a trillionth of a

23

00:01:35,740 --> 00:01:39,890

meter--a picometer--will show up, thus adding

24

00:01:39,910 --> 00:01:44,070

evidence to the theory. So: cutting edge science

25

00:01:44,090 --> 00:01:48,240

or whiz-bang technology? Both, it turns out.

26

00:01:48,260 --> 00:01:52,360

Atom interferometry may be the best way to probe some of the most

27

00:01:52,380 --> 00:01:56,420

essential questions in astrophysics. But the new tools

28

00:01:56,440 --> 00:02:00,590

being built by The Goddard Space Flight Center and Stanford University will have

29

00:02:00,610 --> 00:02:04,780

other applications, too. For example, they could more precisely

30

00:02:04,800 --> 00:02:08,830

track speed, orientation, and inertial changes in one of these...

31

00:02:08,850 --> 00:02:12,940

or help NASA scientists figure out what asteroid