



1
00:00:00,000 --> 00:00:03,870

(Music)

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00:00:03,890 --> 00:00:06,990

Estelle Dodson: People have studied the night skies for thousands of years

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00:00:07,010 --> 00:00:10,770

wondering if another world like ours might be out there.

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00:00:10,790 --> 00:00:14,050

After the first planet was discovered outside our solar system,

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00:00:14,070 --> 00:00:17,150

the real search for an Earth-like planet began.

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00:00:17,170 --> 00:00:22,160

Today, the question still remains unanswered, but probably not for long.

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00:00:22,180 --> 00:00:26,390

Join us as we discover how a team of scientists, working on the Kepler Mission

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00:00:26,410 --> 00:00:29,230

at NASA Ames Research Center, are on a quest

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00:00:29,250 --> 00:00:34,390

to find an Earth-size planet, in orbit around a distant star.

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00:00:34,410 --> 00:00:52,080

(Music)

11
00:00:52,100 --> 00:00:54,760

Estelle Dodson: To give us a better idea of how they hunt for alien worlds,

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00:00:54,780 --> 00:00:58,720

let's meet Bill Borucki, Principal Investigator of the Kepler Mission.

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00:00:58,740 --> 00:01:03,460

Bill, can you tell us a little bit about the Kepler Mission and how you hunt for planets and stars?

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00:01:03,480 --> 00:01:05,040

Bill Borucki: Sure, I'd be delighted to.

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00:01:05,060 --> 00:01:09,800

Basically what we have is a telescope in space that orbits the sun,

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00:01:09,820 --> 00:01:12,460

looks at 150,000 stars constantly,

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00:01:12,480 --> 00:01:15,550

looking to see if a planet crosses any of these stars.

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00:01:15,570 --> 00:01:19,600

Estelle Dodson: And does being outside of the atmosphere help with the observations?

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00:01:19,620 --> 00:01:23,380

Bill Borucki: Having a telescope outside the atmosphere is essential to success.

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00:01:23,400 --> 00:01:28,180

Basically, to look through the Earth's atmosphere you have clouds and dust and day-night cycle.

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00:01:28,200 --> 00:01:30,820

In space, you have none of that.

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00:01:30,840 --> 00:01:34,320

So you have a hundred times more precision.

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00:01:34,340 --> 00:01:38,070

You can find much smaller planets out in space than you could ever find

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00:01:38,090 --> 00:01:40,520

from a ground-based telescope.

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00:01:40,540 --> 00:01:42,620

Estelle Dodson: And what do you do with the data once it comes down,

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00:01:42,640 --> 00:01:45,510
how is this different than say, the Hubble Mission?

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00:01:45,530 --> 00:01:50,120
Bill Borucki: Hubble takes these wonderful images of various galaxies and whatnot.

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00:01:50,140 --> 00:01:55,700
But, what we do instead is we send back just the brightness of each of these 150,000 stars.

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00:01:55,720 --> 00:02:00,100
So basically you're looking at the brightness of a star as it changes with time.

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00:02:00,120 --> 00:02:03,460
Is it constant or did it show dips for planets?

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00:02:03,480 --> 00:02:08,070
So basically it's a search through all this data to find those dips.

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00:02:08,090 --> 00:02:10,160
Estelle Dodson: It sounds like you've been getting great data.

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00:02:10,180 --> 00:02:11,860
Bill Borucki: We're getting absolutely wonderful data.

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00:02:11,880 --> 00:02:16,960
Basically we're getting data over a huge range of objects: stars and planets,

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00:02:16,980 --> 00:02:19,800
small planets, large planets, planets together.

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00:02:19,820 --> 00:02:22,570
We're also getting very precise data.

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00:02:22,590 --> 00:02:27,100
Data that is so precise that we can make measurements that no one has ever made before.

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00:02:27,120 --> 00:02:30,540

People only dreamed they could make these kinds of measurements.

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00:02:30,560 --> 00:02:32,390

Estelle Dodson: So you're really star explorers.

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00:02:32,410 --> 00:02:33,890

Bill Borucki: We're certainly explorers.

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00:02:33,910 --> 00:02:37,320

And we're going to be rewriting the astronomy books on all the stars we're finding

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00:02:37,340 --> 00:02:40,600

and all the planets we're finding,as well.

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00:02:40,620 --> 00:02:43,200

Natalie Batalha: You also see this raining down of points...

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00:02:43,220 --> 00:02:45,890

Estelle Dodson: To tell us more about what's been going on with the Kepler Mission,

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00:02:45,910 --> 00:02:49,430

we're here with Natalie Batalha, Deputy Science Lead.

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00:02:49,450 --> 00:02:52,900

Natalie, how hard is it to see the planets transiting their stars

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00:02:52,920 --> 00:02:55,450

once the science team gets the processed data?

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00:02:55,470 --> 00:02:59,940

Natalie Batalha: Planets about the size of a Neptune or a Jupiter those are really easy to see.

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00:02:59,960 --> 00:03:05,340

Planets the size of an Earth however, those are really truly hidden in the noise.

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00:03:05,360 --> 00:03:09,300

In order to see those we have to build, we have to make use of this very innovative

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00:03:09,320 --> 00:03:12,650

software pipeline that we have spent years developing,

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00:03:12,670 --> 00:03:16,930

and our pipeline is really exceeding our expectations on this front.

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00:03:16,950 --> 00:03:20,790

Estelle Dodson: What has been some of the real exciting things you have been able to discover?

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00:03:20,810 --> 00:03:23,240

Natalie Batalha: The year started off with a bang after the discovery

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00:03:23,260 --> 00:03:25,780

of our first rocky planet: Kepler-10b.

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00:03:25,800 --> 00:03:30,230

We followed right on its heels with the discovery of the Kepler-11 system,

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00:03:30,250 --> 00:03:34,710

where you've got six planets packed so close to their parent star,

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00:03:34,730 --> 00:03:43,060

five of them are within a radius comparable to Mercury's orbit in our own solar system.

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00:03:43,080 --> 00:03:45,520

So it is something very different than our own solar system.

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00:03:45,540 --> 00:03:48,300

So that was very exciting as well.

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00:03:48,320 --> 00:03:52,870

Recently, the team reported on the discovery of Kepler-16b.

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00:03:52,890 --> 00:03:57,130

A Saturn-sized planet orbiting not one but two stars.

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00:03:57,150 --> 00:03:59,630

We call this a circumbinary system.

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00:03:59,650 --> 00:04:02,240
Now we've seen this before in science fiction.

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00:04:02,260 --> 00:04:10,150
George Lucas depicted Luke Skywalker's home world as a world with two suns looming above the horizon.

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00:04:10,170 --> 00:04:14,630
So what was imagined has become reality with the discovery of this planet.

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00:04:14,650 --> 00:04:17,120
(Music)

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00:04:17,140 --> 00:04:20,820
Natalie Batalha: At the end of 2011, we announced two discoveries.

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00:04:20,840 --> 00:04:27,830
The first was Kepler-22b, a planet about 2.4 times the radius of our own Earth,

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00:04:27,850 --> 00:04:31,600
but lies in that just-right temperature region.

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00:04:31,620 --> 00:04:34,870
It's orbiting a star that's almost exactly like our own Sun

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00:04:34,890 --> 00:04:38,300
and it's orbiting out at a 300-day period.

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00:04:38,320 --> 00:04:42,180
The second announcement was Kepler-20e and "f,"

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00:04:42,200 --> 00:04:48,460
two planets orbiting the same star that are likely to have the same kind

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00:04:48,480 --> 00:04:51,930
of composition as Venus and Earth in our own solar system,

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00:04:51,950 --> 00:04:54,710
except they're not at the just-right temperature.

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00:04:54,730 --> 00:04:57,680
So you can see that we're zeroing in on the planets that are both

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00:04:57,700 --> 00:05:01,060
Earth-sized and in the habitable zone...we're almost there.

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00:05:01,080 --> 00:05:04,600
Kepler has exceeded all of our expectations,

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00:05:04,620 --> 00:05:08,350
yet we still know that our most interesting,

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00:05:08,370 --> 00:05:12,410
most compelling results are yet to come.

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00:05:12,430 --> 00:05:15,820
Estelle Dodson: What's been the reaction to the Kepler mission in the large,

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00:05:15,840 --> 00:05:18,010
larger science community?

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00:05:18,030 --> 00:05:22,350
Natalie Batalha: Kepler has been a game changer in exoplanet science.

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00:05:22,370 --> 00:05:26,640
We are having dialogs now that we didn't have two years ago even.

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00:05:26,660 --> 00:05:31,140
The scientific community is going to be working on this database,

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00:05:31,160 --> 00:05:34,970
characterizing these planets for decades to come.

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00:05:34,990 --> 00:05:44,010

But what we will end up with is a deeper understanding of the abundance of Earth-size,

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00:05:44,030 --> 00:05:47,820

potentially habitable worlds in our galaxy.

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00:05:47,840 --> 00:05:48,920

Estelle Dodson: Thanks for joining us!

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00:05:48,940 --> 00:05:54,560

And you can meet us again on our next Destination Innovation.

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00:05:54,580 --> 00:06:03,020

Narrator: To learn more about NASA's Kepler Mission, go to [www dot nasa dot gov slash Kepler](http://www.nasa.gov/Kepler).