1
00:00:00,460 --> 00:00:01,920
- [Narrator] You've seen weird,

2
00:00:01,920 --> 00:00:04,110
wonderful worlds in science fiction.

3
00:00:04,110 --> 00:00:07,700
We don't yet know what sorts
of life might exist out there.

4
00:00:07,700 --> 00:00:10,300
But some of the planets
not unlike the ones

5
00:00:10,300 --> 00:00:13,020
in your favorite stories are real.

6
00:00:13,020 --> 00:00:15,110
At NASA we're studying them.

7
00:00:15,110 --> 00:00:17,220
They're called exoplanets.

8
00:00:17,220 --> 00:00:21,510
The term exoplanet means a
planet outside our solar system,

9
00:00:21,510 --> 00:00:24,030
a planet that doesn't orbit our sun.

10
00:00:24,030 --> 00:00:25,860
Most orbit other stars,

11
00:00:25,860 --> 00:00:28,280
but some are just sunless wanders

12
00:00:28,280 --> 00:00:30,880
out in the space between the stars.

13
00:00:30,880 --> 00:00:34,160
Now, just the fact that
they orbit other stars

14
00:00:34,160 --> 00:00:37,350
means exoplanets are extremely far away.

15
00:00:37,350 --> 00:00:39,266
Most are too far to even dream

16
00:00:39,266 --> 00:00:41,690
of sending space probes to explore them.

17
00:00:41,690 --> 00:00:45,440
So we study them in other
ways, like with telescopes

18
00:00:45,440 --> 00:00:48,230
on the ground and in
space that can observe

19
00:00:48,230 --> 00:00:52,810
these far off planets from
right here in our solar system.

20
00:00:52,810 --> 00:00:54,520
Here's the thing about exoplanets.

21
00:00:54,520 --> 00:00:57,370
They are everywhere.

22
00:00:57,370 --> 00:01:00,150
In fact, from our observation so far,

23
00:01:00,150 --> 00:01:03,290
we know there are more planets than stars.

24

00:01:03,290 --> 00:01:05,670
So there's our solar system.

25
00:01:05,670 --> 00:01:07,600
Then there are all the billions

26
00:01:07,600 --> 00:01:10,440
of planetary systems in
our galaxy, the Milky Way.

27
00:01:10,440 --> 00:01:13,730
Then there are all the
billions of other galaxies.

28
00:01:13,730 --> 00:01:16,600
Basically, there are a lot
of exoplanets out there.

29
00:01:16,600 --> 00:01:19,610
Each of the stars you see
in the night sky is the sun

30
00:01:19,610 --> 00:01:21,980
for any planets that orbit around it.

31
00:01:21,980 --> 00:01:24,640
But not all stars are created equal.

32
00:01:24,640 --> 00:01:27,010
Bigger stars burn way brighter and hotter

33
00:01:27,010 --> 00:01:28,740
and don't last as long.

34
00:01:28,740 --> 00:01:31,410
Smaller, fainter stars like our sun

35
00:01:31,410 --> 00:01:34,090
and red dwarf stars last much longer.

36
00:01:34,090 --> 00:01:38,070
But even nice cool red dwarf
stars can have powerful flares

37
00:01:38,070 --> 00:01:40,690
that blast their planets with radiation.

38
00:01:40,690 --> 00:01:42,680
We're still trying to
understand which kinds

39
00:01:42,680 --> 00:01:45,590
of stars provide long
lasting stable conditions

40
00:01:45,590 --> 00:01:47,760
that could allow life
a chance to take hold

41
00:01:47,760 --> 00:01:50,230
and evolve like it did here on Earth.

42
00:01:50,230 --> 00:01:53,580
Exoplanets are super
hard to see both because

43
00:01:53,580 --> 00:01:55,513
they're so far away and because

44
00:01:55,513 --> 00:01:58,440
they're so much fainter than their stars.

45
00:01:58,440 --> 00:02:01,210
But we've worked out some
clever methods to detect them

46
00:02:01,210 --> 00:02:03,030
and even take pictures of some.

47
00:02:03,030 --> 00:02:05,090
So what can we observe?

48
00:02:05,090 --> 00:02:07,460
Well, for many, we can
determine their size,

49
00:02:07,460 --> 00:02:09,330
their mass, how much they weigh,

50
00:02:09,330 --> 00:02:11,970
and how far away from
their stars they orbit.

51
00:02:11,970 --> 00:02:14,230
From these and a few other clues,

52
00:02:14,230 --> 00:02:16,400
we can infer a bunch of other qualities

53
00:02:16,400 --> 00:02:19,290
like how hot or cold it
might be on their surfaces

54
00:02:19,290 --> 00:02:21,320
or if they even have surfaces.

55
00:02:21,320 --> 00:02:24,360
We can tell that some are
gas giants like Jupiter

56
00:02:24,360 --> 00:02:27,870
while others are like bigger
bulkier versions of Earth.

57
00:02:27,870 --> 00:02:30,540
For some, we can determine
they have atmospheres

58
00:02:30,540 --> 00:02:34,010
and even some of the gases
in those atmospheres.

59
00:02:34,010 --> 00:02:37,320
Most exoplanets are very
different from our planet.

60
00:02:37,320 --> 00:02:40,900
They have a lot of weird
wild variety with gas giants

61
00:02:40,900 --> 00:02:44,100
much bigger than our own
Jupiter and other planets

62
00:02:44,100 --> 00:02:48,870
with oceans of lava or rainy
glass or even gemstone.

63
00:02:48,870 --> 00:02:51,310
Funny thing is looking
at how they're arranged

64
00:02:51,310 --> 00:02:53,930
as families of planets, we don't see a lot

65
00:02:53,930 --> 00:02:57,150
of exoplanet systems that
look like ours so far.

66
00:02:57,150 --> 00:02:59,510
Many are arranged quite differently.

67
00:02:59,510 --> 00:03:02,640
So we might actually be the weird ones.

68
00:03:02,640 --> 00:03:05,390

Some planets are closer to their stars.

69
00:03:05,390 --> 00:03:07,050
Some are super far.

70
00:03:07,050 --> 00:03:09,620
Some even orbit multiple stars.

71
00:03:09,620 --> 00:03:13,810
Imagine having two or
three suns in the sky.

72
00:03:13,810 --> 00:03:16,680
So why do we study exoplanets?

73
00:03:16,680 --> 00:03:18,670
Well, our interest in finding worlds

74
00:03:18,670 --> 00:03:21,250
with life on them is a big factor.

75
00:03:21,250 --> 00:03:24,250
We want to know more about
what makes a planet a place

76
00:03:24,250 --> 00:03:27,380
with all the right ingredients
and conditions for life,

77
00:03:27,380 --> 00:03:30,440
what scientists refer to as habitability.

78
00:03:30,440 --> 00:03:31,590
How does it happen?

79
00:03:31,590 --> 00:03:33,010
How common is it?

80

00:03:33,010 --> 00:03:36,640
We think the most life-ready
planets are the ones

81
00:03:36,640 --> 00:03:39,460
most similar to Earth
with a range of qualities

82
00:03:39,460 --> 00:03:42,660
that include similar size
and composition to our planet

83
00:03:42,660 --> 00:03:45,170
and being at the right
distance from their stars

84
00:03:45,170 --> 00:03:47,320
to have liquid water on the surface.

85
00:03:47,320 --> 00:03:50,430
These qualities are really
challenging to observe

86
00:03:50,430 --> 00:03:54,290
from so far away, but we're working on it.

87
00:03:54,290 --> 00:03:57,260
Exoplanets teach us a
bunch of other things too.

88
00:03:57,260 --> 00:04:00,210
Studying other planetary
systems helps us better

89
00:04:00,210 --> 00:04:03,080
understand the story of
our own planet family

90
00:04:03,080 --> 00:04:04,980
including Earth.

91
00:04:04,980 --> 00:04:08,740
Scientists detected the first
exoplanets in the 1990s.

92
00:04:08,740 --> 00:04:12,840
But now we're finding tons
more, thousands so far.

93
00:04:12,840 --> 00:04:14,390
We're studying their atmospheres

94
00:04:14,390 --> 00:04:16,840
and even making weather maps for some.

95
00:04:16,840 --> 00:04:20,860
We're surveying exoplanets to
understand all their variety.

96
00:04:20,860 --> 00:04:24,350
And the more we learn, the
more it powers our curiosity,