



1
00:00:00,534 --> 00:00:04,271
In May 2016, an international
team of astronomers announced

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00:00:04,271 --> 00:00:07,975
the discovery of three small
exoplanets orbiting an ultracool

3
00:00:07,975 --> 00:00:12,045
dwarf star just 40 light-years
away, called TRAPPIST-1. Now,

4
00:00:12,045 --> 00:00:15,349
the Hubble Space Telescope has
taken the first steps toward

5
00:00:15,349 --> 00:00:19,353
characterizing the atmospheres
of two of these planets. This is

6
00:00:19,353 --> 00:00:23,357
the first time anyone has taken
spectroscopic measurements of an

7
00:00:23,357 --> 00:00:26,326
earth-sized exoplanet. A lot is
unknown about these planets.

8
00:00:26,326 --> 00:00:29,162
Their atmospheres could range
from a thin, tenuous atmosphere

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00:00:29,162 --> 00:00:32,499
like Mars to a mostly gaseous
body composed of hydrogen and

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00:00:32,499 --> 00:00:36,303
helium like Neptune. If there
were large, inhospitable

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00:00:36,303 --> 00:00:39,740
hydrogen-helium atmospheres on
these planets, the Hubble Space

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00:00:39,740 --> 00:00:41,975
Telescope would be able to
detect it through measuring

13
00:00:41,975 --> 00:00:44,845
changes in the host star's
spectrum of light as the planets

14
00:00:44,845 --> 00:00:49,316
pass between us and the star. On
May 4th, Hubble had the rare

15
00:00:49,316 --> 00:00:52,686
opportunity to observe a transit
of both TRAPPIST-1b and

16
00:00:52,686 --> 00:00:56,056
TRAPPIST-1c as they crossed the
disk of their star just minutes

17
00:00:56,056 --> 00:01:00,761
apart. After analyzing the data,
the results are in: these two

18
00:01:00,761 --> 00:01:03,997
earth-sized planets likely do
not have thick hydrogen-helium

19
00:01:03,997 --> 00:01:08,035
atmospheres. They are probably
not miniature gas giants, so

20
00:01:08,035 --> 00:01:11,171
that increases the likelihood
that they could be rocky bodies

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00:01:11,171 --> 00:01:14,474

like Earth. This still leaves several remaining possibilities

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00:01:14,474 --> 00:01:17,511

for their atmospheres. Possibly they have thick atmospheres like

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00:01:17,511 --> 00:01:20,447

Venus. Perhaps they have almost no atmospheres at all, like

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00:01:20,447 --> 00:01:23,850

Mars. Or maybe they have moderate-sized atmospheres with

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00:01:23,850 --> 00:01:26,553

oxygen and water vapor like Earth. The next step in

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00:01:26,553 --> 00:01:29,890

distinguishing between these remaining atmospheric scenarios

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00:01:29,890 --> 00:01:32,859

will be to use the Hubble Space Telescope to follow-up on these

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00:01:32,859 --> 00:01:35,829

two planets and detect whether or not these atmospheres have

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00:01:35,829 --> 00:01:39,433

molecules like water vapor or methane. Then after the James

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00:01:39,433 --> 00:01:42,970

Webb Space Telescope is launched in 2018, Webb will be able to

31
00:01:42,970 --> 00:01:45,405
observe farther into the
infrared wavelengths to measure

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00:01:45,405 --> 00:01:48,842
other important gases like
carbon dioxide or ozone, and

33
00:01:48,842 --> 00:01:51,712
with its increased resolution
will even be able to provide

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00:01:51,712 --> 00:01:54,848
data on atmospheric temperature
and pressure. So we'll soon have

35
00:01:54,848 --> 00:01:57,517
a much more thorough
understanding of the atmospheres

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00:01:57,517 --> 00:02:01,388
of these planets. The TRAPPIST-1
planetary system is one example

37
00:02:01,388 --> 00:02:04,891
of how telescopes on the ground
and in space are making huge

38
00:02:04,891 --> 00:02:07,694
strides in discovering and
characterizing planets with