1
00:00:00,567 --> 00:00:03,503
NASA’s Hubble Space Telescope
has looked for evidence of

2
00:00:03,503 --> 00:00:06,640
atmospheres around several
earth-sized planets in the

3
00:00:06,640 --> 00:00:10,377
TRAPPIST-1 system, including
three that are in the star’s

4
00:00:10,377 --> 00:00:13,280
habitable zone, where liquid
water could exist on the

5
00:00:13,280 --> 00:00:17,885
surface. A lot of astronomers
and space enthusiasts were very

6
00:00:17,885 --> 00:00:21,421
excited by the discovery of the
seven Earth-sized planets of the

7
00:00:21,421 --> 00:00:25,359
TRAPPIST-1 system. The planets
orbit an ultracool dwarf star

8
00:00:25,359 --> 00:00:28,896
about 40 light-years away.
Scientists have theories about

9
00:00:28,896 --> 00:00:31,531
what these planets may be like
and whether they could support

10
00:00:31,531 --> 00:00:35,135
life, but we won’t know for sure
until we get more comprehensive

11
00:00:35,135 --> 00:00:38,505
observations of this system,
including data on the planets'

12
00:00:38,505 --> 00:00:42,709
atmospheres. As a planet in the
TRAPPIST-1 system passes between

13
00:00:42,709 --> 00:00:46,213
us and the star, it blocks out a
small portion of the star's

14
00:00:46,213 --> 00:00:49,449
light. Telescopes like Hubble
can look at changes in specific

15
00:00:49,449 --> 00:00:52,486
wavelengths of light, which
provide clues to the composition

16
00:00:52,486 --> 00:00:56,323
and size of the planet's
atmosphere. Hubble observations

17
00:00:56,323 --> 00:01:00,861
in May, 2016 of TRAPPIST-1 b and
c showed that these planets do

18
00:01:00,861 --> 00:01:05,599
not seem to have thick, puffy
hydrogen-rich atmospheres. This

19
00:01:05,599 --> 00:01:08,568
indicates a higher chance that
they are rocky, terrestrial

20
00:01:08,568 --> 00:01:12,739
planets rather than
mini-gas-giants. Hubble then

21
00:01:12,739 --> 00:01:17,544
observed planets d, e, f, and g
in December 2016 and January

22
00:01:17,544 --> 00:01:21,415
2017 in near-infrared
wavelengths, and the results

23
00:01:21,415 --> 00:01:25,452
were similar. Hubble found no
sign of thick, puffy

24
00:01:25,452 --> 00:01:29,022
hydrogen-rich atmospheres for
any of the four planets. The

25
00:01:29,022 --> 00:01:32,125
data suggest that there isn't
this gas-giant-like atmosphere

26
00:01:32,125 --> 00:01:35,429
for planets d, e, and f. The
data from this round of

27
00:01:35,429 --> 00:01:38,732
observations was not as strong
for planet g, so while there's

28
00:01:38,732 --> 00:01:42,269
no evidence for a thick
hydrogen-rich atmosphere on g,

29
00:01:42,269 --> 00:01:46,206
the researchers are not yet
ruling it out. Planets e, f, and

30
00:01:46,206 --> 00:01:48,875
g orbit at distances where
temperatures would allow for

31
00:01:48,875 --> 00:01:53,113
liquid water, while d is likely
a little too hot. Hubble has yet

32
00:01:53,113 --> 00:01:57,384
to take observations of planet
h, which is outside the system's

33
00:01:57,384 --> 00:02:01,088
habitable zone. To summarize –
Hubble has not seen evidence of

34
00:02:01,088 --> 00:02:06,126
thick, hydrogen-rich atmospheres
for planets b, c, d, e, and f,

35
00:02:06,126 --> 00:02:10,564
and of those five planets, e and
f are in the habitable zone.

36
00:02:10,564 --> 00:02:14,267
Planet g needs more data, and
Hubble has not yet looked at

37
00:02:14,267 --> 00:02:17,104
planet h. It's worth noting
though, that even the planets

38
00:02:17,104 --> 00:02:20,674
outside the habitable zone still
might be able to have liquid

39
00:02:20,674 --> 00:02:24,344
water somewhere on its surface
in certain conditions. It's also

40
00:02:24,344 --> 00:02:26,980
worth noting that if any of
these planets have high-altitude

41
00:02:26,980 --> 00:02:30,651
clouds and hazes, that would
block Hubble’s ability to detect

42
00:02:30,651 --> 00:02:33,387
a thick, hydrogen-rich
atmosphere, but such an

43
00:02:33,387 --> 00:02:36,823
atmosphere is not likely to
exist on these planets. Many

44
00:02:36,823 --> 00:02:39,426
possibilities remain for what
types of atmospheres these

45
00:02:39,426 --> 00:02:43,330
planets have, or whether they
even have atmospheres. The

46
00:02:43,330 --> 00:02:46,533
TRAPPIST-1 planets could have
compact atmospheres similar to

47
00:02:46,533 --> 00:02:51,671
Mars, Venus, Earth, or something
entirely different. Researchers

48
00:02:51,671 --> 00:02:54,608
hope to use Hubble’s ultraviolet
capabilities to look for

49
00:02:54,608 --> 00:02:57,677
evidence of water vapor or
methane, and NASA’s upcoming

50
00:02:57,677 --> 00:03:00,814
James Webb Space Telescope will
look in the far-infrared to

51
00:03:00,814 --> 00:03:04,184
further characterize these
atmospheres. Future telescopes

52
00:03:04,184 --> 00:03:06,386
also hope to look for hints of
whether the planets are

53
00:03:06,386 --> 00:03:10,691
habitable and if life could be
present. The TRAPPIST-1 system

54
00:03:10,691 --> 00:03:14,294
provides the best opportunity we
currently have to study

55
00:03:14,294 --> 00:03:18,298
Earth-size exoplanets. Over the
next few years, Hubble and other

56
00:03:18,298 --> 00:03:21,568
telescopes will work together,
each contributing important

57
00:03:21,568 --> 00:03:25,672
observations. For the first time
ever, we'll have an in-depth

58
00:03:25,680 --> 00:03:29,420
understanding of a set of
terrestrial planets outside our

59
00:03:29,420 --> 00:03:30,620
solar system.