1 00:04:35.942 --> 00:04:38.076
SCIENTISTS WHEN WE SAW THIS

2 00:04:37.843 --> 00:04:42.180
THING?

3 00:04:38.209 --> 00:04:43.948
WAS IT SHOCKING OR WERE WE

4 00:04:42.314 --> 00:04:46.084
LOOKING FOR IT?

5 00:04:44.083 --> 00:04:46.919
>> THINKING ABOUT OUR OWN SOLAR

6 00:04:46.218 --> 00:04:49.154
SYSTEM WHERE HE WITH HAVE A LOT

7 00:04:47.052 --> 00:04:59.697
OF PLANETS AND A LOT OF MOONS

8 00:04:49.288 --> 00:05:01.199
AROUND THOSE PLANETS.

9 00:05:01.334 --> 00:05:05.937
THERE ARE SO MANY MOONS IN OUR

10 00:05:03.069 --> 00:05:07.506
SOLAR SYSTEM FINDING ONE OUTSIDE

11 00:05:05.072 --> 00:05:09.007
OUR SOLAR SYSTEM AROUND ANOTHER

12 00:05:07.639 --> 00:05:12.076
STAR AROUND ANOTHER PLANETS

13 00:05:09.141 --> 00:05:13.444
NOT SURPRISING.

14 00:05:09.141 --> 00:05:13.444
IT'S JUST -- IT SHOWS YOU SINCE
WE'VE ONLY FOUND ONE HOW

DIFFICULT IT IS TO FIND THESE

SMALL SIGNALS AND SO, I'M SURE

OVER TIME WE CAN FIND MORE, BUT

WHO KNOWS IF THEY'LL BE ANYTHING

LIKE OUR OWN MOON OR EARTH

SYSTEM.

YOU NEVER KNOW.

A FEW MORE QUESTIONS COMING

I

IN.

IT'S POSSIBLE WE MIGHT HAVE A

BINARY PLANETARY SYSTEM.

IN THIS CASE THE CANDIDATE MOON
WE HAVE SOMETHING LIKE 1.5%

THE MATH OF ITS PLANET SIMILAR TO THE EARTH's AND OUR MOON

RATIO OF MASS.

THE SIZE DIFFERENCE IS PRONOUNCED BETWEEN THIS MOON AND ITS PLANET AND SO IT's MORE -- I THINK IT WOULD BE MORE ACCURATELY DESCRIBED THIS IS CONFIRMED AS A MOON PLANET SYSTEM AS OPPOSED TO A BINARY PLANET SYSTEM SIMPLY BECAUSE OF THAT DIFFERENCE IN SIZE AND MASS RATIO.
BUT WE NEED A FEW MORE

44 00:06:46,605 --> 00:06:51,843
OBSERVATIONS LEARN MORE.

45 00:06:48,940 --> 00:06:56,381
>> THE VERY NEXT QUESTION WAS

46 00:06:51,976 --> 00:06:58,416
HOW BIG IS THE MOON?

47 00:06:56,514 --> 00:06:59,651
>> I THINK'S LARGE.

48 00:06:58,550 --> 00:07:02,653
WE CAN COMPARE IT SOMETHING LIKE

49 00:06:59,785 --> 00:07:04,156
NEPTUNE IN OUR OWN SOLAR SYSTEM.

50 00:07:02,788 --> 00:07:07,893
WE'RE NOT USED TO HAVING MOONS

51 00:07:04,290 --> 00:07:09,228
THAT ARE BIGGER THAN PLANET --

52 00:07:08,026 --> 00:07:10,562
THAT MUCH BIGGER THAN PLANET

53 00:07:09,362 --> 00:07:12,197
EARTH IN OUR OWN SOLAR SYSTEM SO

54 00:07:10,696 --> 00:07:14,399
IT'S HARD TO COMPARE.

55 00:07:12,331 --> 00:07:16,201
THINK ABOUT THE EARTH'S MOON

56 00:07:14,533 --> 00:07:16,268
SYSTEM THAT WE'RE ACCUSTOMED TO

57 00:07:16,367 --> 00:07:28,579
AND THEN IT.
WITH A NEPTUNE-SIZED BOTH

GASIOUS TYPE BODIES.

SO IT’s MUCH LARGE EARL THAN

WHAT WE ARE ACCUSTOMED TO TO ANY

TYPE OF SYSTEM IN OUR OWN SOLAR

SYSTEM.

>> IT’s NICE TO FIND NEW THINGS.

SPEAKING OF WHICH, WE HAD A

FACEBOOK FOLLOWER ASKING IF WE

PLAN TO SEND A PROBE TO THIS

EXOMOON?

KNICOLE, WHAT DO YOU THINK OF

HA?

>> THAT WOULD BE AMAZING.
WE COULD DO THAT.

BUT JENNIFER MENTIONED BEFORE

HOW FAR AWAY IT

IT'S 8,000 LIGHT YEARS AWAY.

WHICH MEANS THAT EVEN IF WE

COULD TRAVEL AT THE SPEED OF

LIGH IT WOULD TAKE 8,000 YEARS

TO THERE.

IT WOULD BE ONE OF THESE AWESOME

NICE TO HAVE THINGS, BUT I THINK

IT WILL BE A WHILE BEFORE WE

HAVE THE TECHNOLOGY TO BE ABLE

TO SPEND SOMEONE THERE,

UNFORTUNATELY.
00:08:15,326 --> 00:08:18,930
>> WE DON'T HAVE WARP DRIVE YET.

87
00:08:16,762 --> 00:08:20,499
>> YEAH, WE NEED WARP DRIVE.

88
00:08:19,064 --> 00:08:20,899
>> CONTINUE TO SEND YOUR

89
00:08:20,632 --> 00:08:22,400
QUESTIONS.

90
00:08:21,033 --> 00:08:25,971
TWAOER TAKING THEM LIVE USING

91
00:08:22,533 --> 00:08:27,973
THE #ASKNASA.

92
00:08:26,105 --> 00:08:28,741
THE NEXT QUESTION IS FROM

93
00:08:28,139 --> 00:08:32,210
FACEBOOK AND SOMEONE ASKED WHY

94
00:08:28,874 --> 00:08:35,980
SHOULD WE BE LIMITING THE SEARCH

95
00:08:32,344 --> 00:08:37,015
TO WATER/CARBON-BASED PLANETS?

96
00:08:36,115 --> 00:08:39,750
>> VERY GOOD QUESTION.

97
00:08:37,149 --> 00:08:40,586
WE DON'T KNOW WHAT WE DON'T

98
00:08:39,884 --> 00:08:41,753
KNOW.

99
00:08:40,720 --> 00:08:42,821
SO, LIFE FORMS COULD BE

100
00:08:41,919 --> 00:08:45,524
DIFFERENT FROM THE TYPE OF LIFE

THAT WE ARE ACCUSTOMED TO ON

PLANET EARTH.

WE'VE ALL SEEN A LOT OF SCIENCE

FICTION BUT THERE ARE GOOD

REASONS TO THINK THAT COMPLEX

LIFE WOULD PROBABLY BE CARBON

BASED AND PROBABLY NEEDS SOME

CONNECTION TO LIQUID WATER.

THAT's CERTAINLY WHAT WE FOUND

ON PLANET EARTH AND ALSO AT

LEAST FROM OUR EXPERIENCE HERE

TO RECOGNIZE WHAT THAT TYPE OF

LIFE WOULD DO TO ITS ATMOSPHERE,

SUCH THAT WE COULD DETECT IT
FROM A DISTANCE AND LOOK AT THE ATMOSPHERIC CHARACTERISTICS AND KNOW THAT THERE MUST BE SOME BIOLOGICAL ACTIVITY GOING ON.

THOSE ARE SOME OF THE REASONS WHY IT MAKE SENSE TO LOOK FOR LIFE THAT HAS SOME SIMILAR BASIS TO THE LIFE FORMS THAT WE ARE FAMILIAR WITH ON PLANET EARTH.

>> A LOT OF GOOD QUESTIONS FROM A LOT OF GOOD QUESTIONS FROM FACEBOOK.

HOW DO WE MEASURE THE DISTANCE TO AN EXOPLANET OR EXOMOON?
SO, THE SIZE IS ESSENTIALLY

WE'RE USING THE SAME WAY WE USED TO FIND IT IN THE FIRST PLACE.

SO IT'S SOMETHING CALLED THE TRANSIT METHOD.

WHERE BASICALLY BLOCKS A FRACTION OF THE LIGHT OF THE STAR, AND BASED ON HOW MUCH IT BLOCKS IT'S LIKE A RATIO OF AREAS.

SO YOU CAN SAY, OH, 1% OF LIGHT IS BLOCKED WHICH MEANS NOT SOME SPECIFIC SIZE HAD TO BLOCK THAT SIZE, THAT AMOUNT
OF LIGHT.

AND SO IN THAT WAY, WE'RE ABLE TO MEASURE THE RADIUS OF THE PLANET.

THAT MEANS WE ALSO NEED TO KNOW THE SIZE OF THE STAR IN ORDER TO COMPARE THE TWO.

BUT WE CAN KNOW THAT FROM USING OBSERVATIONS FROM EITHER OTHER TELESCOPES AS WELL.

THERE'S LIKE THIS WHOLE ARMY OF TELESCOPES.

YOU NEED TO ABLE TO FIND THE PLANETS AND MEASURE THEIR
PROPERTIES AND LEARN MORE ABOUT

00:10:40,938 --> 00:10:43,307
THEM.

00:10:41,240 --> 00:10:44,943
IN TERMS OF THE DISTANCE -- THAT

00:10:43,475 --> 00:10:46,745
WAS THE OTHER PART OF THE

00:10:45,076 --> 00:10:50,182
QUESTION -- HOW WE MEASURE THE

00:10:46,879 --> 00:10:54,086
DISTANCE, THERE WAS ACTUALLY A

00:10:50,316 --> 00:10:55,120
MISSION CALLED GYA THAT IS

00:10:54,220 --> 00:10:57,589
COLLECTING DATA TO MEASURE

00:10:55,254 --> 00:10:59,457
POSITIONS OF STARS IN THE SKY.

00:10:57,722 --> 00:11:02,227
BA ON THAT WE ACTUALLY CAN

00:10:59,591 --> 00:11:03,260
MEASURE KIND OF LIKE THIS ANGLE

00:11:02,360 --> 00:11:05,463
OF HOW MUCH THEY MOVE.

00:11:03,394 --> 00:11:07,966
AND THAT ACTUALLY TELLS US THE

00:11:05,597 --> 00:11:11,902
DISTANCE AWAY FROM EARTH.

00:11:08,100 --> 00:11:13,272
SO IT'S REALLY AGAIN AN ARMY OF
TELESCOPES THAT OPERATES IN

CONCER PROVIDE ALL THIS

INFORMATION TO GET US THESE SIZE

AND EVN MASS, DISTANCE,

EVERYTHING.

IT'S A LOT OF WORK BUT IT's

DEFINITELY WORTH IT.

WE'RE LUCKY WE have A GREAT

TEAM.

WE've GOT ANOTHER QUESTION

FROM #ASK

IT IS HOW MUCH STRONGER IS

GRAVITY ON THIS EXOMOON AS
COMPARED TO EARTH?

>> WELL, THAT'S A VERY GOOD QUESTION.

I THINK I WOULD HAVE TO SIT AND CALCULATE THAT OUT.

>> PUT YOU ON THE SPOT.

>> WE KNOW THAT ITS MASS -- ARE THEY ASKING ABOUT THE MOON OR PLANET?

>> IT LOOKS LIKE COMPARED TO EARTH.

HOW MUCH STRONGER IS THE GRAVITY ON THIS EXOMOON COMPARED TO EARTH.
SO THIS MOON IS LARGER AN EARTH, BASICALLY THE SIZE OF NEPTUNE SO IT WILL HAVE A STRONGER FIELD.

I CAN'T TELL YOU THAT BECAUSE WE DON'T KNOW THE ACTUAL MAP OF THE MOON BUT IT WILL BE STRONG.

IT'S ALSO GOING TO BE AN ODD THING TO IMAGINE BECAUSE IT DOESN'T HAVE A SOLID SURFACE.

IF YOU'RE THINKING ABOUT JUMPING UP AND DOWN ON THIS MOON LIKE YOU MIGHT DO ON EARTH's MOON YOU WON'T HAVE THE SAME RIENCE.
THAT MAY HAVE INTERESTING IMPLICATIONS FOR THE ATMOSPHERE IN THIS MOON.

WHERE WE CAN ACTUALLY MEASURE S-THE COMPOSITION OF THE ATMOSPHERE OF THIS MOON AND COMPARE IT TO LET’S SAY PLANETS IN OUR SOLAR SYSTEM, WE MAY BE ABLE TO UNDERSTAND SOMETHING ABOUT HOW THAT MOON HAS BEEN FORMED, WHAT ITS NATURE IS AND HOW THAT STRONG GRAVITATIONAL FIELD ARE AFFECTING LAYERS OF GASES ARE AROUND THE MOON.

I LOOK FORWARD TO LEARNING THE
EFFECTS OF THE FIELD AND MAGNETIC FIELD WHEN WE HAVE FUTURE OBSERVATIONS.

>> WE'LL HAVE TO WAIT AND SEE.

IF OUR OWN EARTH WAS THIS FAR AWAY, WOULD WE BE ABLE TO DETECT IT?

>> SO IF OUR EARTH WAS 8,000 LIGHT YEARS AWAY, THE SAE DISTANCE?

THAT's A GOOD QUESTION.

SO THE INITIAL PLANET THAT THIS MOON ORBITS AROUND IS A JUPITER-SIZED PLANET WHICH IS
SOMETHING LIKE 10, 11, 12 TIMES THE SIZE OF EARTH.

SO IT CAUSES A LARGE DIP IN LIGHT.

SO THE EARTH WOULD CAUSE A MUCH SMALLER DIP.

LIKE .10 OF JUPITER CAUSES.

WE WOULD NEED VERY, VERY PRECISE INSTRUMENTS AND KEPLER DID DISCOVER SEVERAL EARTH-SIZED EXOPLANETS.

BUT THEN TO HAVE AN EXOMOON AROUND IT, THAT'S SOMETHING WE HAVEN'T DISCOVERED YET.
SO, YOU KNOW, THERE'S -- IT'S

TRICKY IS THE ANSWER.

IT DEPENDS ON A LOT OF THINGS.

BUT YOU KNOW, IT'S NOT

IMPOSSIBLE.

YOU JUST NEED TO MAKE SURE YOU

HAVE THE RIGHT TELESCOPE

BASICALLY.

>> LET'S SEE.

CONTINUE TO SEND YOUR QUESTIONS

TO

HOW DOES THE HE CAN THROW

MAGNETIC FIELD COMPARE TO EARTH.

DO WE HAVE ANY INFORMATION ON
THAT YET

00:15:03,335 --> 00:15:05,370
?

00:15:03,869 --> 00:15:08,072
>>'s A GREAT QUESTION.

00:15:07,371 --> 00:15:08,605
INFORMATION ABOUT THIS WHOLE

00:15:08,206 --> 00:15:10,408
SYSTEM.

00:15:08,740 --> 00:15:12,778
AS I MENTIONED EARLIER WE THINK

00:15:10,542 --> 00:15:16,247
THAT THE STAR THAT THIS PLANET

00:15:12,910 --> 00:15:18,949
AND POTENTIAL MOON ARE ORBITING

00:15:16,380 --> 00:15:19,884
IS NOT TOO DIFFERENT FROM OUR

00:15:19,083 --> 00:15:22,886
SUN.

00:15:20,018 --> 00:15:24,556
IT WILL HAVE SOME OF THE SAME

00:15:23,020 --> 00:15:27,825
CHARACTERISTICS AS THE SUN THAT

00:15:24,722 --> 00:15:29,293
MIGHT INACT INTERACT

00:15:27,960 --> 00:15:31,830
OCCASIONALLY THE STELLAR

00:15:29,427 --> 00:15:34,365
ACTIVITY MAY INTERACT WITH THIS
PLANET AND ITS SYSTEM JUST THE
SAME WAY OUR SUN HAS CERTAIN
ACTIVITIES AND FLAIRS THAT
INTERACT WITH OUR EARTH MOON
SYSTEM AND THEN IT'S QUITE
POSSIBLE THAT THIS PLANET OH
THAT THIS MOON IS ASSOCIATED
WITH WOULD HAVE A MAGNETIC FIELD
AND WOULD IMPACT ITS MOON AND
WOULD AFFECT THE ENVIRONMENT
THERE AND THAT WOULD AFFECT HOW
FLAIRS AND PARTICLES, COSMIC TH
RAYS COMING FROM ITS PARENT
STAR.
WE DON'T KNOW WHAT THE MAGNETIC FIELD MIGHT BE AROUND THE SYSTEM.

WE KNOW IT WILL GET THE SAME BALLPARK RADIATION AS WE GET FROM THE SUN IN OUR RTH-MOON SYSTEM AND THIS WILL IMPACT WHETHER THERE IS ANY SORT OF HABITABILITY IN THIS REGION AT THE VERY LEAST IT WILL BE INTERESTING TO STUDY. I'M JUST -- WE KEEP TALKING ABOUT FUTURE TELESCOPES BUT I'M VERY KEEN ABOUT THIS DIRECTION
OF STROPB MY.

FUTURE TELESCOPES LIKE THE JAMES WEBB SPACE TELESCOPE ARE GOING TO BE ABLE TO GIVE US MORE DETAILS ABOUT THE NATURE OF THIS THE ENVIRONMENTS AROUND THEM AND WHAT THEIR MONS MIGHT BE LIKE IN TERMS OF THEIR INTERACTIONS WITH MAGNETIC FIELDS AND RADIATION, TEMPERATURES AND ALL KINDS OF THINGS.

SO THIS IS JUST THE BEGINNING OF OUR INVESTIGATION INTO THIS WHOLE TYPE OF OBJECT.
THIS IS AN INTERESTING QUESTION.

AND IT MAY BE A LITTLE BIT DIFFICULT.

IS IT POSSIBLE THAT THIS MOON COULD HAVE ITS OWN MOON?

ANYTHING IS POSSIBLE AS WE'VE BEEN DISCOVERING ALL KIND OF EXOPLANETS AND THINGS WE DIDN'T KNOW COULD EXIST.

THINGS LIKE THIS THAT WE NEVER, EVER DREAMED OF AND EXOMOON HAVING ITS OWN MOON IS
POSSIBLE ESPECIALLY WHEN THIS

MOON IS SO MASSIVE THAT MAYBE IT

COULD -- WILL USE ITS GRAVITY TO

CAPTURE OTHER SMALLER BODIES

AROUND IT.

LIKE MARS HAS 2 TINY MOONS

RELATIVELY SPEAKING COMPARED TO

OUR MOON.

SO MAYBE THERE ARE TINY MOONS

THAT ARE CAPTURED AND THEY'RE

ORBITING BUT WE DON'T HAVE THE

RIGHT INSTRUMENTS TO ABLE TO

DETECT THEM RIGHT NOW.

BUT IT's POSSIBLE.
THAT COULD BE COOL.

WE ENDED UP TALKING ABOUT HUBBLE AND WE'VE BEEN TALKING ABOUT NASA's ANNIVERSARY. NASA HAS BEEN AROUND 60 YEARS AND HUBBLE HAS BEEN AROUND ALMOST HALF THAT TIME.

HOW IS OUR TELESCOPE DOING?

WE'RE EXCITED ABOUT HUBBLE.

IT'S BEEN AROUND ALMOST HALF THE TIME THAT NASA AND WE CELEBRATED HUBBLE's 28TH BIRTHDAY.

HUBBLE HAS BEEN WORKING WELL BECAUSE WE HAVE THIS TERRIFIC
CREW OF PEOPLE ON THE GROUND
KEEPING IT STRONG,
SCIENTIFICALLY WORKING AND
SEVERAL CRUISE OF ASTRONAUTS
OVER THE YEARS COMING BACK TO
UPGRADE THE TELESCOPE AND
SERVICE IT AND KEEPING IT IN TOP SHAPE.
HUBBLE IS IN GREAT SHAPE.
WE'RE GETTING SOME OF THE BEST
SCIENCE OUT OF IT NOW THAN EVER
BEFORE IN ITS HISTORY.
WE'RE LEARNING NOT ONLY ABOUT
THE ATMOSPHERE FROM EXOPLANETS
BUT ALSO LEARNING ABOUT STAR SYSTEMS AND OTHER GALAXIES AND EVEN THE WHOLE UNIVERSE, THE HISTORY OF THE UNIVERSE AND WE ANTICIPATE GETTING ABOUT GOOD SCIENCE FROM HUBBLE FOR QUITE A FEW YEARS TO COME.

IN FACT, HE WITH ARE HOPING THAT HEH OVERLAP WITH THE JAMES WEBB SPACE TELESCOPE WHICH WILL LAUNCH IN 2021 AND OVERLAP FOR SEVERAL YEARS BECAUSE THESE COMPLIMENTARY LABORATORIES WILL GIVE US TERRIFIC SCIENCE, FROM INFRARED ALL THE WAY INTO THE
VISIBLE COLOR OUR EYES CAN SEE.

THIS GIVES US A GREAT ZEAL OF INFORMATION ABOUT WHATEVER WE'RE STUDYING WHETHER IT'S EXOPLANET OR PLANETS IN OUR OWN SOLAR SYSTEM AND OF COURSE OTHER STARS.

HUBBLE IS BEING USED TO COMPLIMENT THE INFORMATION THAT WE'RE GETTING FROM PROBES THAT WE'RE SENDING WITHIN OUR OWN SOLAR SYSTEM, FOR EXAMPLE, THE JUNEAU PROBE STUDYING JUPITER IS.
SENDING BACK INFORMATION.

WE USED IT ALONG WITH NEW HORIZONS TO STUDY PLUTO AND OUTSIDE OF OUR SOLAR SYSTEM AND IN THE DEEP UNIVERSE.

I THINK HUBBLE IS INATPE AND WILL BE FOR QUITE A FEW YEARS TO COME.

UNFORTUNATELY THIS IS THE END OF THE SHOW.

IF YOU WANT TO KNOW MORE ABOUT HUBBLE OR ABOUT THIS EXOMOON,

CAN GO TO THE WEBSITE NASA.GOV/HUBBLE.
WE GOT AN INTERACTIVE TIMELINE

AND CHECK OUT A 360 TOUR OF OUR SPACE TELESCOPE CONTROL ROOM AND SEE WHERE ALL THE ACTION HAPPENS

AND UPLOADED HOURS OF HUBBLE HISTORIC VIDEO FOR YOU TO CHECK

HEAD TO VERY, VERY HAPPY

BIRTHDAY TO NASA. VERY, VERY HAP NASA.