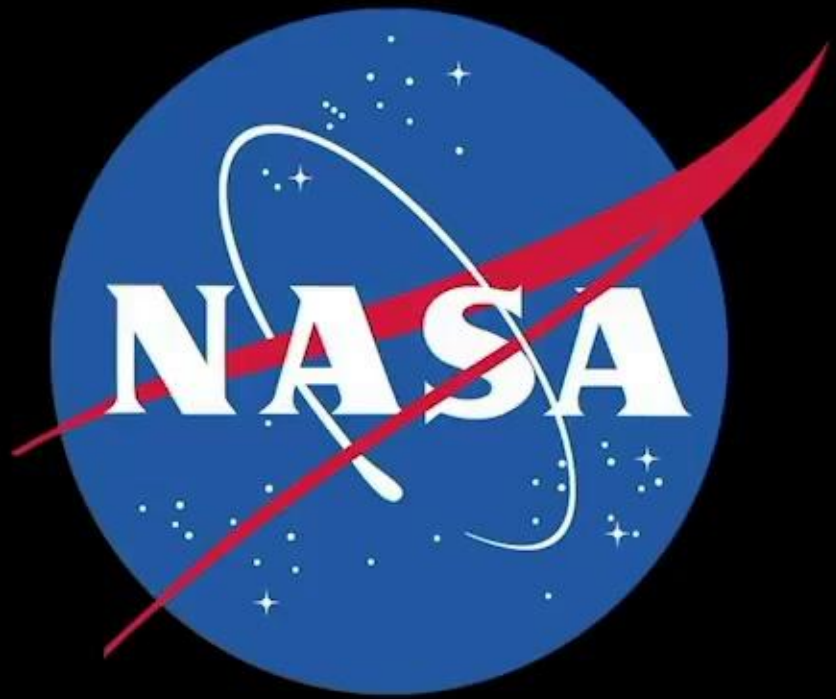

Goddard

SPACE FLIGHT CENTER

1
00:00:05,829 --> 00:00:02,389
a large mirror that can collect a lot of

2
00:00:08,310 --> 00:00:05,839
light to get very precise data so we can

3
00:00:10,870 --> 00:00:08,320
again look to recover the same signal

4
00:00:13,350 --> 00:00:10,880
and you know help verify this

5
00:00:16,470 --> 00:00:13,360
this exomoon candidate that has been

6
00:00:19,269 --> 00:00:16,480
identified and in addition

7
00:00:19,990 --> 00:00:19,279
beyond just looking at the same system

8
00:00:22,630 --> 00:00:20,000
the

9
00:00:25,910 --> 00:00:22,640
tess mission just started collecting

10
00:00:28,150 --> 00:00:25,920
data recently and it launched in april

11
00:00:30,550 --> 00:00:28,160
of this year and tess is the transiting

12
00:00:31,669 --> 00:00:30,560
exoplanet survey satellite

13
00:00:34,310 --> 00:00:31,679

and

14
00:00:37,670 --> 00:00:34,320
since july actually it started science

15
00:00:40,150 --> 00:00:37,680
it is basically doing a nearly all sky

16
00:00:42,310 --> 00:00:40,160
survey compared to kepler mission which

17
00:00:44,950 --> 00:00:42,320
observed just one part of the sky

18
00:00:47,270 --> 00:00:44,960
tess is looking at almost the entire sky

19
00:00:49,510 --> 00:00:47,280
for exoplanets doing the same exact

20
00:00:51,830 --> 00:00:49,520
thing looking for dips in the light

21
00:00:53,910 --> 00:00:51,840
and in this case

22
00:00:56,470 --> 00:00:53,920
tess is looking at a lot of bright stars

23
00:00:58,150 --> 00:00:56,480
a lot of nearby stars so it's looking at

24
00:00:59,750 --> 00:00:58,160
a very different sample of stars and

25
00:01:01,670 --> 00:00:59,760
kepler looked at but

26
00:01:03,830 --> 00:01:01,680
there's still a possibility that we will

27
00:01:06,870 --> 00:01:03,840
find lots of planets and maybe some of

28
00:01:08,550 --> 00:01:06,880
those will have exo moons around them so

29
00:01:10,070 --> 00:01:08,560
i guess we'll all have to stay tuned and

30
00:01:11,190 --> 00:01:10,080
speaking of stay tuned maybe you're just

31
00:01:12,630 --> 00:01:11,200
tuning in

32
00:01:14,230 --> 00:01:12,640
we're live at nasa's goddard space

33
00:01:17,270 --> 00:01:14,240
flight center we're talking about exo

34
00:01:19,429 --> 00:01:17,280
moons crazy um send your questions into

35
00:01:21,510 --> 00:01:19,439
hashtag ask nasa and we'll get to just

36
00:01:22,950 --> 00:01:21,520
as many as we can throughout the show

37
00:01:24,390 --> 00:01:22,960
one of the questions that i had seen

38
00:01:26,469 --> 00:01:24,400

from the press release when it came out

39
00:01:29,749 --> 00:01:26,479
on wednesday people were asking about

40
00:01:32,230 --> 00:01:29,759
how you know how far is this away from

41
00:01:35,830 --> 00:01:32,240
us oh good question so

42
00:01:38,390 --> 00:01:35,840
um we think this system is about 8 000

43
00:01:40,469 --> 00:01:38,400
light years away of course the light

44
00:01:42,310 --> 00:01:40,479
year is the distance that it takes for

45
00:01:44,630 --> 00:01:42,320
light to travel in a year

46
00:01:46,469 --> 00:01:44,640
and so it's not right around the corner

47
00:01:49,590 --> 00:01:46,479
from our solar system but it is in our

48
00:01:53,190 --> 00:01:49,600
galaxy and not too far away cosmically

49
00:01:56,230 --> 00:01:53,200
speaking so it's in the the

50
00:01:59,190 --> 00:01:56,240
constellation sagittarius or no what's

51
00:02:00,789 --> 00:01:59,200
the oh it's in cygnus cygnus sorry it's

52
00:02:02,230 --> 00:02:00,799
in cygnus this is the region of the sky

53
00:02:04,389 --> 00:02:02,240
that kepler was

54
00:02:06,149 --> 00:02:04,399
observing and so that's why the system

55
00:02:07,510 --> 00:02:06,159
was found in the first place by kepler

56
00:02:09,749 --> 00:02:07,520
and so um

57
00:02:12,390 --> 00:02:09,759
it's not easy for us to see

58
00:02:14,309 --> 00:02:12,400
especially this candidate of an exo moon

59
00:02:16,390 --> 00:02:14,319
we have to have powerful telescopes but

60
00:02:19,830 --> 00:02:16,400
it's in our own galaxy so it's not

61
00:02:22,309 --> 00:02:19,840
terribly far away no astronomically

62
00:02:25,030 --> 00:02:22,319
so it's not so far away another question

63
00:02:27,510 --> 00:02:25,040

we were getting of course is um could

64
00:02:29,510 --> 00:02:27,520
there be life

65
00:02:31,589 --> 00:02:29,520
could there be yeah that's a question

66
00:02:34,309 --> 00:02:31,599
everybody always wants to know

67
00:02:37,110 --> 00:02:34,319
and um again this this system this

68
00:02:39,830 --> 00:02:37,120
planet and this moon exo moon is

69
00:02:41,270 --> 00:02:39,840
orbiting at a distance from its star

70
00:02:43,509 --> 00:02:41,280
that means that

71
00:02:45,589 --> 00:02:43,519
at that region the temperature it has

72
00:02:47,750 --> 00:02:45,599
could be a temperature where liquid

73
00:02:49,990 --> 00:02:47,760
water exists or it is a temperature

74
00:02:52,869 --> 00:02:50,000
where liquid water exists but these two

75
00:02:56,229 --> 00:02:52,879
particular objects are so um large and

76
00:02:57,990 --> 00:02:56,239
massive that they're basically um like

77
00:02:59,910 --> 00:02:58,000
balls of gas you know they're not

78
00:03:00,630 --> 00:02:59,920
they're they're gas giants essentially

79
00:03:02,949 --> 00:03:00,640
or

80
00:03:04,229 --> 00:03:02,959
and they're nothing um like our own

81
00:03:06,070 --> 00:03:04,239
earth you know they don't have this

82
00:03:09,270 --> 00:03:06,080
rocky surface that you can really walk

83
00:03:13,350 --> 00:03:09,280
around on so the prospects of life on

84
00:03:14,470 --> 00:03:13,360
this planet and this moon itself um is

85
00:03:15,350 --> 00:03:14,480
very slim

86
00:03:17,350 --> 00:03:15,360
but

87
00:03:19,750 --> 00:03:17,360
where there's one planet often we find

88
00:03:21,190 --> 00:03:19,760

more so there might be more planets in

89
00:03:21,990 --> 00:03:21,200
the system

90
00:03:23,990 --> 00:03:22,000
where

91
00:03:26,470 --> 00:03:24,000
you know could be that could be rocky we

92
00:03:29,030 --> 00:03:26,480
just haven't had the um

93
00:03:30,550 --> 00:03:29,040
the sensitivity to detect them yet so

94
00:03:33,110 --> 00:03:30,560
that's something that you know we'll see

95
00:03:34,149 --> 00:03:33,120
in the future if we're able to tell

96
00:03:36,630 --> 00:03:34,159
whether or not there's additional

97
00:03:38,869 --> 00:03:36,640
planets in the system that could have

98
00:03:40,710 --> 00:03:38,879
ingredients for life well i guess we'll

99
00:03:41,990 --> 00:03:40,720
have to stay tuned um and we're actually

100
00:03:43,270 --> 00:03:42,000
starting to take in some of your

101
00:03:45,589 --> 00:03:43,280
questions keep sending them and i've got

102
00:03:48,470 --> 00:03:45,599
some really good ones here um

103
00:03:50,710 --> 00:03:48,480
hashtag ass nasa of course um

104
00:03:53,190 --> 00:03:50,720
so jennifer you're just talking about

105
00:03:54,470 --> 00:03:53,200
the temperature of the moon what what is

106
00:03:56,070 --> 00:03:54,480
the temperature

107
00:03:57,990 --> 00:03:56,080
of the moon

108
00:04:01,350 --> 00:03:58,000
well again we don't know too much about

109
00:04:03,429 --> 00:04:01,360
this moon yet we know roughly its size

110
00:04:05,350 --> 00:04:03,439
it's mass it's huge

111
00:04:07,190 --> 00:04:05,360
but we don't really know all these

112
00:04:09,030 --> 00:04:07,200
details but we can kind of estimate the

113
00:04:11,509 --> 00:04:09,040

researchers who

114
00:04:13,110 --> 00:04:11,519
were detecting this object estimated his

115
00:04:14,470 --> 00:04:13,120
temperature based on his distance and

116
00:04:17,509 --> 00:04:14,480
likely composition

117
00:04:20,069 --> 00:04:17,519
so we think it's a balmy maybe 80

118
00:04:22,710 --> 00:04:20,079
degrees fahrenheit up to 170 degrees

119
00:04:25,110 --> 00:04:22,720
fahrenheit so you know warm but not

120
00:04:26,830 --> 00:04:25,120
boiling hot yes

121
00:04:29,350 --> 00:04:26,840
perfect for

122
00:04:31,590 --> 00:04:29,360
life um

123
00:04:34,150 --> 00:04:31,600
so nicole was this was this a surprise

124
00:04:35,830 --> 00:04:34,160
for scientists when we saw this thing

125
00:04:38,150 --> 00:04:35,840
was it was it shocking or were we

126
00:04:40,469 --> 00:04:38,160
looking for it what

127
00:04:43,270 --> 00:04:40,479
well you know thinking about our own

128
00:04:45,430 --> 00:04:43,280
solar system where we have a lot of

129
00:04:47,510 --> 00:04:45,440
planets and we have a lot of moons

130
00:04:50,070 --> 00:04:47,520
around those planets um jupiter and

131
00:04:52,310 --> 00:04:50,080
saturn both have many many planets or

132
00:04:53,590 --> 00:04:52,320
sorry many moons around them

133
00:04:55,430 --> 00:04:53,600
um

134
00:04:57,030 --> 00:04:55,440
you know there's so many moons in our

135
00:04:59,510 --> 00:04:57,040
own solar system essentially that

136
00:05:01,670 --> 00:04:59,520
finding even just one outside

137
00:05:03,430 --> 00:05:01,680
our solar system around another star

138
00:05:05,270 --> 00:05:03,440

around another planet is not that

139
00:05:07,350 --> 00:05:05,280
surprising um

140
00:05:10,390 --> 00:05:07,360
it's just it shows you though since

141
00:05:14,070 --> 00:05:10,400
we've only found one how difficult it is

142
00:05:16,150 --> 00:05:14,080
to find these small signals and so

143
00:05:17,909 --> 00:05:16,160
you know i'm sure over time we can buy

144
00:05:19,430 --> 00:05:17,919
more um but

145
00:05:22,310 --> 00:05:19,440
who knows if there'll be anything like

146
00:05:24,790 --> 00:05:22,320
our own moon earth system you never know

147
00:05:25,670 --> 00:05:24,800
all right so a few more questions coming

148
00:05:27,670 --> 00:05:25,680
in

149
00:05:30,070 --> 00:05:27,680
um

150
00:05:32,710 --> 00:05:30,080
jennifer is it possible to one day find

151
00:05:36,550 --> 00:05:32,720
exoplanets that have binary orbits like

152
00:05:39,270 --> 00:05:36,560
pluto or and sharon in that system

153
00:05:41,110 --> 00:05:39,280
well um certainly it's possible i mean

154
00:05:43,350 --> 00:05:41,120
this is very interesting

155
00:05:45,430 --> 00:05:43,360
um if you have you know one body

156
00:05:47,350 --> 00:05:45,440
orbiting a star and then something

157
00:05:49,270 --> 00:05:47,360
perhaps orbiting that body as we do in a

158
00:05:52,950 --> 00:05:49,280
moon planet system but then there can

159
00:05:55,029 --> 00:05:52,960
also be sort of binary planet situations

160
00:05:57,590 --> 00:05:55,039
the definition of that is not always

161
00:05:59,270 --> 00:05:57,600
completely clear so it's certainly

162
00:06:02,070 --> 00:05:59,280
possible in the system that we might

163
00:06:04,390 --> 00:06:02,080

have a binary planetary system

164
00:06:07,430 --> 00:06:04,400
in this case though the candidate moon

165
00:06:08,909 --> 00:06:07,440
that we have is something like

166
00:06:12,150 --> 00:06:08,919
you know

167
00:06:16,150 --> 00:06:12,160
1.5 percent the mass of its

168
00:06:18,629 --> 00:06:16,160
planet that's similar to the earth

169
00:06:21,430 --> 00:06:18,639
in our moon ratio of mass

170
00:06:24,390 --> 00:06:21,440
the size difference is pronounced

171
00:06:27,430 --> 00:06:24,400
between also between this moon and its

172
00:06:28,870 --> 00:06:27,440
planet and so it's more

173
00:06:31,909 --> 00:06:28,880
i think it would be more accurately

174
00:06:34,390 --> 00:06:31,919
described if this is confirmed as a moon

175
00:06:37,189 --> 00:06:34,400
planet system as opposed to a binary

176
00:06:40,150 --> 00:06:37,199
planet system simply because of that

177
00:06:42,390 --> 00:06:40,160
difference in size and mass ratio but we

178
00:06:44,150 --> 00:06:42,400
need a few more observations to to learn

179
00:06:45,189 --> 00:06:44,160
more details and it's interesting you

180
00:06:47,270 --> 00:06:45,199
should say that because the very next

181
00:06:48,870 --> 00:06:47,280
question that i got in was how big is

182
00:06:52,790 --> 00:06:48,880
the moon

183
00:06:54,950 --> 00:06:52,800
well it's it's large i mean we think um

184
00:06:58,070 --> 00:06:54,960
again we can compare it to something

185
00:06:59,589 --> 00:06:58,080
like neptune in our own solar system so

186
00:07:02,950 --> 00:06:59,599
uh you know we're not used to having

187
00:07:05,189 --> 00:07:02,960
moons that are bigger than planet that

188
00:07:07,270 --> 00:07:05,199

much bigger than planet earth in our own

189
00:07:09,430 --> 00:07:07,280
solar system so it's really hard to

190
00:07:11,909 --> 00:07:09,440
compare this is you know think about the

191
00:07:13,270 --> 00:07:11,919
earth moon system that we're accustomed

192
00:07:15,110 --> 00:07:13,280
to and then

193
00:07:17,990 --> 00:07:15,120
expand it

194
00:07:20,670 --> 00:07:18,000
and then you've got this a huge system a

195
00:07:23,510 --> 00:07:20,680
very large jupiter-like planet with a

196
00:07:24,950 --> 00:07:23,520
neptune-sized moon both gaseous type

197
00:07:27,909 --> 00:07:24,960
bodies

198
00:07:29,830 --> 00:07:27,919
as the system so it's much larger than

199
00:07:31,909 --> 00:07:29,840
what we're accustomed to to any type of

200
00:07:33,749 --> 00:07:31,919
system in our own solar system

201
00:07:35,909 --> 00:07:33,759
it's exciting you know it's nice to find

202
00:07:38,070 --> 00:07:35,919
new things um

203
00:07:41,029 --> 00:07:38,080
speaking of which we had a facebook

204
00:07:43,270 --> 00:07:41,039
follower asking um if we plan to send a

205
00:07:44,790 --> 00:07:43,280
probe to this exo moon nicole what do

206
00:07:47,189 --> 00:07:44,800
you think about that oh gosh i mean that

207
00:07:49,029 --> 00:07:47,199
would be amazing if we could do that um

208
00:07:51,670 --> 00:07:49,039
but jennifer mentioned before how far

209
00:07:52,550 --> 00:07:51,680
away it is um it's 8 000 light years

210
00:07:55,350 --> 00:07:52,560
away

211
00:07:57,510 --> 00:07:55,360
which means that even if we could travel

212
00:07:59,350 --> 00:07:57,520
at the speed of light it would take 8

213
00:08:00,150 --> 00:07:59,360

000 years to get there

214
00:08:02,390 --> 00:08:00,160
so

215
00:08:04,950 --> 00:08:02,400
you know it's it would be you know one

216
00:08:06,710 --> 00:08:04,960
of these awesome nice to have things but

217
00:08:08,629 --> 00:08:06,720
i think it'll be a while before we have

218
00:08:10,390 --> 00:08:08,639
the technology to be able to send a

219
00:08:13,350 --> 00:08:10,400
probe there unfortunately we don't have

220
00:08:15,110 --> 00:08:13,360
warp drive yet yes we need warp drive

221
00:08:17,029 --> 00:08:15,120
i continue to send in your questions

222
00:08:20,390 --> 00:08:17,039
we're taking them live from social media

223
00:08:22,390 --> 00:08:20,400
using the hashtag asknasa

224
00:08:24,869 --> 00:08:22,400
so the next question that i got was from

225
00:08:26,869 --> 00:08:24,879
facebook and somebody asked why should

226
00:08:29,830 --> 00:08:26,879
we be limiting the search for life to

227
00:08:31,270 --> 00:08:29,840
water slash carbon-based planets

228
00:08:32,149 --> 00:08:31,280
very good question

229
00:08:33,750 --> 00:08:32,159
so

230
00:08:36,230 --> 00:08:33,760
um you know

231
00:08:38,709 --> 00:08:36,240
we don't know what we don't know so so

232
00:08:40,709 --> 00:08:38,719
life forms could be very different from

233
00:08:42,469 --> 00:08:40,719
the type of life that we are accustomed

234
00:08:44,310 --> 00:08:42,479
to on planet earth we've all seen a lot

235
00:08:46,389 --> 00:08:44,320
of science fiction

236
00:08:48,790 --> 00:08:46,399
but there are some good reasons to think

237
00:08:51,110 --> 00:08:48,800
that complex life would probably be

238
00:08:53,190 --> 00:08:51,120

carbon-based and probably need some

239
00:08:55,269 --> 00:08:53,200
connection to liquid water that's

240
00:08:57,829 --> 00:08:55,279
certainly what we found on planet earth

241
00:08:59,829 --> 00:08:57,839
and we also are able at least from our

242
00:09:02,870 --> 00:08:59,839
experience here to recognize what that

243
00:09:04,949 --> 00:09:02,880
type of life would do to its atmosphere

244
00:09:06,630 --> 00:09:04,959
such that we could detect it from a

245
00:09:08,470 --> 00:09:06,640
distance and look at the atmospheric

246
00:09:10,389 --> 00:09:08,480
characteristics and know that there must

247
00:09:12,389 --> 00:09:10,399
be some kind of biological activity

248
00:09:15,430 --> 00:09:12,399
going on so those are some of the

249
00:09:18,150 --> 00:09:15,440
reasons why it makes sense to look for

250
00:09:20,470 --> 00:09:18,160
life that has some similar basis to the

251
00:09:23,030 --> 00:09:20,480
life forms that we are familiar with on

252
00:09:25,110 --> 00:09:23,040
planet earth makes sense

253
00:09:26,870 --> 00:09:25,120
um a lot of questions for facebook good

254
00:09:30,630 --> 00:09:26,880
ones um

255
00:09:32,790 --> 00:09:30,640
so how do we measure how do we go about

256
00:09:35,190 --> 00:09:32,800
measuring the size and distance to an

257
00:09:39,430 --> 00:09:35,200
exoplanet or an exo moon

258
00:09:41,269 --> 00:09:39,440
so the size is um a

259
00:09:43,110 --> 00:09:41,279
it's essentially we're using the same

260
00:09:44,230 --> 00:09:43,120
way we used to find it in the first

261
00:09:45,829 --> 00:09:44,240
place

262
00:09:48,150 --> 00:09:45,839
so it's something called the transit

263
00:09:50,630 --> 00:09:48,160

method where basically the

264
00:09:51,829 --> 00:09:50,640
planet blocks a fraction of the light of

265
00:09:54,470 --> 00:09:51,839
the star

266
00:09:57,670 --> 00:09:54,480
and based on how much it blocks it's

267
00:09:59,829 --> 00:09:57,680
kind of like a ratio of areas

268
00:10:01,910 --> 00:09:59,839
so you can say

269
00:10:05,350 --> 00:10:01,920
oh one percent of light is blocked which

270
00:10:07,350 --> 00:10:05,360
means some object of some specific size

271
00:10:08,870 --> 00:10:07,360
had to block that size

272
00:10:11,350 --> 00:10:08,880
that amount of light

273
00:10:14,230 --> 00:10:11,360
and so in that case in that way we're

274
00:10:16,630 --> 00:10:14,240
able to measure the radius of the planet

275
00:10:19,990 --> 00:10:16,640
that means we also need to know the size

276
00:10:23,269 --> 00:10:20,000
of the star in order to compare the two

277
00:10:25,350 --> 00:10:23,279
but we can know that from using

278
00:10:27,110 --> 00:10:25,360
observations from even other telescopes

279
00:10:28,790 --> 00:10:27,120
as well so there's like this whole army

280
00:10:30,949 --> 00:10:28,800
of telescopes you need to be able to

281
00:10:33,430 --> 00:10:30,959
really find the planets and measure

282
00:10:34,230 --> 00:10:33,440
their properties and um

283
00:10:36,069 --> 00:10:34,240
and

284
00:10:37,990 --> 00:10:36,079
you know learn more about them

285
00:10:40,790 --> 00:10:38,000
and in terms of the distance right that

286
00:10:42,470 --> 00:10:40,800
was the other part of the question uh so

287
00:10:45,990 --> 00:10:42,480
how we measure the distance there was

288
00:10:49,190 --> 00:10:46,000

actually um an uh mission called gaia

289
00:10:51,829 --> 00:10:49,200
that is recently collecting data to

290
00:10:53,670 --> 00:10:51,839
measure positions of stars in the sky

291
00:10:56,550 --> 00:10:53,680
and based on measuring the positions of

292
00:10:59,110 --> 00:10:56,560
the stars we actually can measure kind

293
00:11:00,470 --> 00:10:59,120
of like this angle of how much they move

294
00:11:02,630 --> 00:11:00,480
and that

295
00:11:04,230 --> 00:11:02,640
actually tells us the distance away from

296
00:11:06,630 --> 00:11:04,240
earth so

297
00:11:08,710 --> 00:11:06,640
it's it's really again an army of

298
00:11:11,110 --> 00:11:08,720
telescopes that operates you know in

299
00:11:14,069 --> 00:11:11,120
concert to provide all this information

300
00:11:15,590 --> 00:11:14,079
to get us the size even mass you know

301
00:11:17,829 --> 00:11:15,600
distance everything

302
00:11:19,509 --> 00:11:17,839
so it's a lot of work but it's it's

303
00:11:21,750 --> 00:11:19,519
definitely worth it so we're lucky we

304
00:11:23,110 --> 00:11:21,760
have a great team that's right

305
00:11:25,670 --> 00:11:23,120
um

306
00:11:27,509 --> 00:11:25,680
so we've got another question from ask

307
00:11:30,230 --> 00:11:27,519
nasa um

308
00:11:33,590 --> 00:11:30,240
it is how much stronger is the gravity

309
00:11:36,069 --> 00:11:33,600
on this exo moon compared to than

310
00:11:40,310 --> 00:11:38,310
well that's a very good question i think

311
00:11:45,829 --> 00:11:40,320
i would have to sit and calculate that

312
00:11:49,190 --> 00:11:48,310
we know that it's mass

313
00:11:50,389 --> 00:11:49,200

uh

314
00:11:53,350 --> 00:11:50,399
they were they asked about the moon or

315
00:11:55,509 --> 00:11:53,360
the planet so it looks it looks like

316
00:11:57,110 --> 00:11:55,519
compared to earth how much stronger is

317
00:11:57,990 --> 00:11:57,120
the gravity on this x-moon compared to

318
00:11:59,350 --> 00:11:58,000
earth

319
00:12:01,590 --> 00:11:59,360
okay so this

320
00:12:03,430 --> 00:12:01,600
moon is

321
00:12:05,350 --> 00:12:03,440
basically larger than earth it's

322
00:12:07,110 --> 00:12:05,360
basically the size of neptune so it's

323
00:12:08,870 --> 00:12:07,120
going to have a stronger gravitational

324
00:12:10,310 --> 00:12:08,880
field based on the mass difference

325
00:12:11,990 --> 00:12:10,320
between the moon and the earth i can't

326
00:12:14,310 --> 00:12:12,000
actually tell you that because we don't

327
00:12:15,430 --> 00:12:14,320
know for sure the actual mass of this

328
00:12:17,910 --> 00:12:15,440
moon

329
00:12:20,550 --> 00:12:17,920
but it's going to be stronger and it's

330
00:12:22,710 --> 00:12:20,560
also going to be an odd thing to imagine

331
00:12:24,550 --> 00:12:22,720
because it doesn't have a solid surface

332
00:12:26,069 --> 00:12:24,560
so if you're thinking about you know

333
00:12:27,829 --> 00:12:26,079
jumping up and down on this moon like

334
00:12:29,590 --> 00:12:27,839
you might do on earth's moon if you were

335
00:12:32,710 --> 00:12:29,600
an astronaut you're not going to have

336
00:12:34,470 --> 00:12:32,720
the same experience so it's stronger and

337
00:12:36,150 --> 00:12:34,480
that may have actually interesting

338
00:12:37,350 --> 00:12:36,160

implications for the layers of

339
00:12:39,430 --> 00:12:37,360
atmosphere

340
00:12:41,590 --> 00:12:39,440
in this moon so if we have future

341
00:12:43,110 --> 00:12:41,600
telescopes where we can actually

342
00:12:45,430 --> 00:12:43,120
measure the composition of the

343
00:12:47,990 --> 00:12:45,440
atmosphere of this moon and compare it

344
00:12:49,910 --> 00:12:48,000
to let's say planets in our own gaseous

345
00:12:52,310 --> 00:12:49,920
planets in our own solar system we may

346
00:12:54,710 --> 00:12:52,320
be able to understand something about

347
00:12:56,710 --> 00:12:54,720
how that moon has been formed what its

348
00:12:59,269 --> 00:12:56,720
nature is and how that strong

349
00:13:00,389 --> 00:12:59,279
gravitational field is affecting how the

350
00:13:04,069 --> 00:13:00,399
layers of

351
00:13:06,069 --> 00:13:04,079
of gases are arranging themselves in

352
00:13:07,910 --> 00:13:06,079
this moon so i look forward to being

353
00:13:10,230 --> 00:13:07,920
able to understand the effects of the

354
00:13:12,470 --> 00:13:10,240
gravitational field and maybe even a

355
00:13:14,150 --> 00:13:12,480
magnetic field when we have future

356
00:13:15,430 --> 00:13:14,160
observations

357
00:13:18,710 --> 00:13:15,440
so we're just going to have to wait and

358
00:13:20,389 --> 00:13:18,720
see for a lot of these questions um

359
00:13:21,910 --> 00:13:20,399
so this is actually a really interesting

360
00:13:25,110 --> 00:13:21,920
question um

361
00:13:27,910 --> 00:13:25,120
if our own earth was this far away would

362
00:13:30,230 --> 00:13:27,920
we be able to detect it

363
00:13:32,949 --> 00:13:30,240

so if our earth was like 8 000 light

364
00:13:35,990 --> 00:13:32,959
years away i guess at the same distance

365
00:13:37,990 --> 00:13:36,000
um that's a good question it

366
00:13:40,150 --> 00:13:38,000
so the initial

367
00:13:42,550 --> 00:13:40,160
planet that that this moon orbits around

368
00:13:45,030 --> 00:13:42,560
is a jupiter-sized planet which is

369
00:13:47,509 --> 00:13:45,040
something like 10 11 12 times the size

370
00:13:49,030 --> 00:13:47,519
of earth so it causes a pretty large dip

371
00:13:51,189 --> 00:13:49,040
in light

372
00:13:54,629 --> 00:13:51,199
so the earth being that much smaller

373
00:13:56,550 --> 00:13:54,639
would cause a much smaller dip um like a

374
00:13:59,910 --> 00:13:56,560
tenth of of what

375
00:14:02,230 --> 00:13:59,920
um that jupiter causes so

376
00:14:04,550 --> 00:14:02,240
we would basically need you know very

377
00:14:07,430 --> 00:14:04,560
very precise instruments and kepler did

378
00:14:08,949 --> 00:14:07,440
discover um several earth-sized

379
00:14:11,509 --> 00:14:08,959
exoplanets

380
00:14:12,629 --> 00:14:11,519
um but then to have you know an exomoon

381
00:14:13,990 --> 00:14:12,639
around it

382
00:14:14,870 --> 00:14:14,000
that's something we haven't discovered

383
00:14:16,629 --> 00:14:14,880
yet

384
00:14:18,870 --> 00:14:16,639
so you know there's

385
00:14:19,990 --> 00:14:18,880
it's tricky

386
00:14:23,110 --> 00:14:20,000
is the answer

387
00:14:25,110 --> 00:14:23,120
um it depends on a lot of things um but

388
00:14:27,030 --> 00:14:25,120

you know it's not um

389
00:14:28,629 --> 00:14:27,040
it's not impossible you just need to

390
00:14:31,509 --> 00:14:28,639
make sure you have the right you know

391
00:14:36,150 --> 00:14:31,519
telescope basically

392
00:14:39,350 --> 00:14:37,430
continue sending your questions into

393
00:14:41,269 --> 00:14:39,360
hashtag s nasa by the way we will get to

394
00:14:44,550 --> 00:14:41,279
as many as we can and we'll get to some

395
00:14:46,790 --> 00:14:44,560
after the show too i'm sure um so

396
00:14:49,189 --> 00:14:46,800
how does the gravity well if we discuss

397
00:14:51,030 --> 00:14:49,199
gravity how's the electromagnetic field

398
00:14:52,710 --> 00:14:51,040
of that exomoon compared to earth do we

399
00:14:53,750 --> 00:14:52,720
do we even have any information on that

400
00:14:55,670 --> 00:14:53,760
yet

401
00:14:57,990 --> 00:14:55,680
well that's a that's a great question

402
00:14:59,509 --> 00:14:58,000
because that would impact all kinds of

403
00:15:00,550 --> 00:14:59,519
things about the environment about that

404
00:15:01,509 --> 00:15:00,560
exome

405
00:15:03,350 --> 00:15:01,519
so

406
00:15:05,590 --> 00:15:03,360
we don't have a lot of information about

407
00:15:08,230 --> 00:15:05,600
this whole system but as as i mentioned

408
00:15:11,509 --> 00:15:08,240
earlier we think that the star that this

409
00:15:14,710 --> 00:15:11,519
planet and potential moon are orbiting

410
00:15:16,069 --> 00:15:14,720
um is not too different from our sun so

411
00:15:17,910 --> 00:15:16,079
it's going to have some of those same

412
00:15:20,150 --> 00:15:17,920
characteristics of the sun which would

413
00:15:22,310 --> 00:15:20,160

include magnetic field activity that

414
00:15:24,550 --> 00:15:22,320
might in fact interact

415
00:15:27,509 --> 00:15:24,560
occasionally the the stellar activity

416
00:15:29,430 --> 00:15:27,519
may interact with this planet and its

417
00:15:31,590 --> 00:15:29,440
moon its system just the same way as our

418
00:15:32,710 --> 00:15:31,600
sun has certain activity flares and so

419
00:15:34,389 --> 00:15:32,720
forth that

420
00:15:36,150 --> 00:15:34,399
interact with our

421
00:15:39,670 --> 00:15:36,160
earth moon system

422
00:15:41,829 --> 00:15:39,680
and then it's quite possible that this

423
00:15:43,990 --> 00:15:41,839
planet that this moon is associated with

424
00:15:46,389 --> 00:15:44,000
would have a magnetic field that

425
00:15:48,790 --> 00:15:46,399
magnetic field would impact

426
00:15:51,030 --> 00:15:48,800
its moon and it would affect the

427
00:15:54,069 --> 00:15:51,040
environment there that would infect how

428
00:15:55,990 --> 00:15:54,079
that system is interacting with flares

429
00:15:58,710 --> 00:15:56,000
and particles cosmic rays coming from

430
00:16:00,870 --> 00:15:58,720
its parent star so we don't know yet

431
00:16:02,550 --> 00:16:00,880
what the magnetic field might be around

432
00:16:05,350 --> 00:16:02,560
that system we know it's going to get

433
00:16:08,230 --> 00:16:05,360
the same you know ballpark radiation

434
00:16:09,110 --> 00:16:08,240
from its parent star as we get from the

435
00:16:11,590 --> 00:16:09,120
sun

436
00:16:13,910 --> 00:16:11,600
in our earth moon system

437
00:16:16,949 --> 00:16:13,920
and this will impact whether there is

438
00:16:18,150 --> 00:16:16,959

any sort of habitability in this region

439
00:16:20,629 --> 00:16:18,160
at the very least it will be very

440
00:16:22,790 --> 00:16:20,639
interesting to study so i'm just we keep

441
00:16:25,430 --> 00:16:22,800
talking about future telescopes but i'm

442
00:16:27,509 --> 00:16:25,440
i'm very keen about this direction of

443
00:16:30,310 --> 00:16:27,519
astronomy because we are using the

444
00:16:32,710 --> 00:16:30,320
telescopes we have like hubble um and

445
00:16:34,470 --> 00:16:32,720
soon tests to learn what we can but

446
00:16:37,590 --> 00:16:34,480
future telescopes like the james webb

447
00:16:41,030 --> 00:16:37,600
space telescope are going to be able to

448
00:16:44,150 --> 00:16:41,040
give us more details about the nature of

449
00:16:45,829 --> 00:16:44,160
this exoplanet system and others

450
00:16:47,990 --> 00:16:45,839
and the environments around them and

451
00:16:49,829 --> 00:16:48,000
what their moons might be like in terms

452
00:16:51,590 --> 00:16:49,839
of their interactions with magnetic

453
00:16:53,110 --> 00:16:51,600
fields with radiation

454
00:16:55,269 --> 00:16:53,120
temperatures

455
00:16:57,829 --> 00:16:55,279
all kinds of things so this is just the

456
00:17:00,230 --> 00:16:57,839
beginning of our investigation into this

457
00:17:02,710 --> 00:17:00,240
whole type of object

458
00:17:03,670 --> 00:17:02,720
it's a new science

459
00:17:04,630 --> 00:17:03,680
so

460
00:17:09,189 --> 00:17:04,640
this is

461
00:17:11,750 --> 00:17:09,199
may be a little bit difficult uh is it

462
00:17:12,949 --> 00:17:11,760
possible that this moon could have its

463
00:17:15,189 --> 00:17:12,959

own moons

464
00:17:18,789 --> 00:17:15,199
oh that is a great question

465
00:17:20,549 --> 00:17:18,799
and a difficult one um well first it i

466
00:17:22,710 --> 00:17:20,559
mean i'll say anything's possible you

467
00:17:25,110 --> 00:17:22,720
know as we've been discovering all kinds

468
00:17:27,029 --> 00:17:25,120
of exoplanets first of all things that

469
00:17:29,590 --> 00:17:27,039
we didn't know could exist

470
00:17:31,190 --> 00:17:29,600
that orbit so close to their star that

471
00:17:33,350 --> 00:17:31,200
you know they orbit within one day

472
00:17:34,710 --> 00:17:33,360
compared to our one year orbit so things

473
00:17:37,029 --> 00:17:34,720
like this that we've never even dreamed

474
00:17:39,750 --> 00:17:37,039
of um so

475
00:17:42,310 --> 00:17:39,760
an exo moon having its own moons is

476
00:17:44,710 --> 00:17:42,320
possible especially when um

477
00:17:46,630 --> 00:17:44,720
this moon is so massive that maybe it

478
00:17:48,950 --> 00:17:46,640
could what we call you know use its

479
00:17:51,990 --> 00:17:48,960
gravity to capture other smaller bodies

480
00:17:53,990 --> 00:17:52,000
around it um like mars has two very tiny

481
00:17:55,029 --> 00:17:54,000
moons relatively speaking compared to

482
00:17:57,590 --> 00:17:55,039
our moon

483
00:17:59,590 --> 00:17:57,600
so maybe there's some very tiny moons

484
00:18:01,830 --> 00:17:59,600
that have been captured by this moon and

485
00:18:03,510 --> 00:18:01,840
are orbiting but we just don't have the

486
00:18:05,190 --> 00:18:03,520
right instruments to be able to detect

487
00:18:08,870 --> 00:18:05,200
them right now

488
00:18:10,630 --> 00:18:08,880

and yeah but it's definitely possible

489
00:18:11,430 --> 00:18:10,640
that could be cool

490
00:18:13,029 --> 00:18:11,440
so

491
00:18:14,230 --> 00:18:13,039
we've been talking about hubble and

492
00:18:17,190 --> 00:18:14,240
we've been talking about nasa's

493
00:18:18,870 --> 00:18:17,200
anniversary and um so nasa's been around

494
00:18:21,110 --> 00:18:18,880
for 60 years and hubble's been around

495
00:18:22,549 --> 00:18:21,120
for almost half that time how's our

496
00:18:24,789 --> 00:18:22,559
telescope doing

497
00:18:26,789 --> 00:18:24,799
well we're excited about hubble so as

498
00:18:28,549 --> 00:18:26,799
you say hubble's been around almost half

499
00:18:31,430 --> 00:18:28,559
the time that nasa's been around and we

500
00:18:32,789 --> 00:18:31,440
just celebrated hubble's 28th

501
00:18:34,390 --> 00:18:32,799
birthday

502
00:18:36,070 --> 00:18:34,400
earlier this year

503
00:18:38,470 --> 00:18:36,080
hubble's been working well because we

504
00:18:41,270 --> 00:18:38,480
have this terrific crew of people on the

505
00:18:43,029 --> 00:18:41,280
ground that are keeping it a strong

506
00:18:45,190 --> 00:18:43,039
scientifically working and we've had

507
00:18:46,230 --> 00:18:45,200
several crews of astronauts over the

508
00:18:48,470 --> 00:18:46,240
years

509
00:18:50,310 --> 00:18:48,480
coming back to

510
00:18:52,470 --> 00:18:50,320
upgrade the telescope and service it

511
00:18:54,870 --> 00:18:52,480
keeping it in tip-top shape so

512
00:18:56,950 --> 00:18:54,880
hubble is in great shape we're getting

513
00:18:59,590 --> 00:18:56,960

some of the best science out of it now

514
00:19:01,510 --> 00:18:59,600
than ever before in its history we're

515
00:19:03,430 --> 00:19:01,520
learning not only about the atmospheres

516
00:19:05,430 --> 00:19:03,440
of some exoplanets but we're also

517
00:19:07,110 --> 00:19:05,440
learning about star systems other

518
00:19:08,549 --> 00:19:07,120
galaxies even the whole universe the

519
00:19:10,310 --> 00:19:08,559
history of the universe

520
00:19:12,150 --> 00:19:10,320
and we anticipate getting good science

521
00:19:13,029 --> 00:19:12,160
from hubble for quite a few years to

522
00:19:15,510 --> 00:19:13,039
come

523
00:19:17,350 --> 00:19:15,520
in fact we are hoping that we overlap

524
00:19:19,909 --> 00:19:17,360
with the james webb space telescope

525
00:19:21,830 --> 00:19:19,919
which will launch in 2021

526
00:19:23,270 --> 00:19:21,840
and overlap with that telescope for

527
00:19:25,029 --> 00:19:23,280
several years because these

528
00:19:26,870 --> 00:19:25,039
complementary observatories are going to

529
00:19:30,150 --> 00:19:26,880
give us terrific science they're going

530
00:19:32,470 --> 00:19:30,160
to cover the wavelength range of light

531
00:19:34,549 --> 00:19:32,480
from mid infrared all the way through

532
00:19:36,070 --> 00:19:34,559
the visible colors that our eyes can see

533
00:19:38,870 --> 00:19:36,080
and on into the higher energy

534
00:19:40,710 --> 00:19:38,880
ultraviolet light this gives us a great

535
00:19:43,110 --> 00:19:40,720
deal of information about whatever we're

536
00:19:43,909 --> 00:19:43,120
studying whether it's exoplanets

537
00:19:46,549 --> 00:19:43,919
or

538
00:19:48,150 --> 00:19:46,559

planets planets in our own solar system

539
00:19:50,549 --> 00:19:48,160
and and of course other stars and

540
00:19:52,390 --> 00:19:50,559
galaxies and we complement other

541
00:19:54,549 --> 00:19:52,400
missions you know hubble is being used

542
00:19:56,950 --> 00:19:54,559
to complement the information that we're

543
00:19:58,789 --> 00:19:56,960
getting from probes that we're sending

544
00:20:01,029 --> 00:19:58,799
within our own solar system for example

545
00:20:02,630 --> 00:20:01,039
the juno probe studying

546
00:20:04,149 --> 00:20:02,640
jupiter in our own solar system is

547
00:20:05,830 --> 00:20:04,159
sending back information that we're

548
00:20:08,710 --> 00:20:05,840
correlating with observations from

549
00:20:11,029 --> 00:20:08,720
hubble we're using we've used it along

550
00:20:13,029 --> 00:20:11,039
with new horizons to study

551
00:20:15,110 --> 00:20:13,039
pluto we're using it with other missions

552
00:20:18,070 --> 00:20:15,120
to study things outside of our solar

553
00:20:20,149 --> 00:20:18,080
system and in in the deep universe

554
00:20:21,750 --> 00:20:20,159
so i think hubble's in great shape and

555
00:20:23,350 --> 00:20:21,760
will be for quite a few years to come

556
00:20:25,750 --> 00:20:23,360
and that makes me very happy that makes

557
00:20:28,230 --> 00:20:25,760
me very happy but unfortunately this is

558
00:20:29,830 --> 00:20:28,240
the end of the show um

559
00:20:32,310 --> 00:20:29,840
if you want to know more about hubble or

560
00:20:34,470 --> 00:20:32,320
about this exo moon you can go to our

561
00:20:35,909 --> 00:20:34,480
website nasa.gov hubble we got a bunch

562
00:20:38,789 --> 00:20:35,919
of great new products up there we've got

563
00:20:40,870 --> 00:20:38,799

an interactive timeline that you can see

564
00:20:42,950 --> 00:20:40,880
hubble milestones you can check out a

565
00:20:44,630 --> 00:20:42,960
360 tour of our space telescope

566
00:20:46,390 --> 00:20:44,640
operations control room you can see

567
00:20:48,789 --> 00:20:46,400
where all the action happens and we've

568
00:20:51,029 --> 00:20:48,799
uploaded hours of hubble historical

569
00:20:53,110 --> 00:20:51,039
video for you to check out so head to

570
00:20:55,350 --> 00:20:53,120
nasa.gov hubble or you can find us on

571
00:20:56,870 --> 00:20:55,360
social media at nasa hubble and