

The word "Kepler" is written in a large, blue, stylized font. A yellow orbital path loops around the letters, with a small Earth-like planet positioned at the top of the loop. In the upper left, a yellow star is surrounded by several elliptical orbits with small planets. The background is a dark space filled with stars and a nebula.

Kepler

MEDIA BRIEFING

June 19, 2017 • 8 am PDT / 11 am EDT

NASA's Ames Research Center • www.nasa.gov/ames



1
00:01:18,260 --> 00:01:16,820
hi I'm Michelle Johnson public affairs

2
00:01:20,120 --> 00:01:18,270
manager here at NASA Ames Research

3
00:01:22,160 --> 00:01:20,130
Center in California Silicon Valley

4
00:01:24,590 --> 00:01:22,170
today we're here to hear the latest

5
00:01:28,190 --> 00:01:24,600
results from NASA's exoplanet hunting

6
00:01:31,460 --> 00:01:28,200
mission the Kepler mission we have four

7
00:01:34,010 --> 00:01:31,470
panelists here today to tell us their to

8
00:01:35,539 --> 00:01:34,020
share the latest results and we'll be

9
00:01:37,490 --> 00:01:35,549
addressing our live audience as well as

10
00:01:39,020 --> 00:01:37,500
those on the phone for those joining on

11
00:01:42,770 --> 00:01:39,030
Ustream there will be a 30-second delay

12
00:01:45,859 --> 00:01:42,780
in the stream from what's happening here

13
00:01:47,450 --> 00:01:45,869

in the the newsroom for all the graphics

14

00:01:51,710 --> 00:01:47,460

that the panelists are using you can go

15

00:01:54,770 --> 00:01:51,720

to the web at WWF gov forward slash

16

00:01:56,930 --> 00:01:54,780

Kepler so the panelists will each give

17

00:01:59,600 --> 00:01:56,940

their short briefing and then we're

18

00:02:01,010 --> 00:01:59,610

going to switch to QA we'll take our

19

00:02:02,690 --> 00:02:01,020

live audience first and then go to the

20

00:02:04,700 --> 00:02:02,700

phone and then for those of you

21

00:02:06,800 --> 00:02:04,710

following on social media you can ask

22

00:02:09,740 --> 00:02:06,810

your question via Twitter take your

23

00:02:11,240 --> 00:02:09,750

question with hashtag ask Kepler the

24

00:02:14,600 --> 00:02:11,250

media briefing will be limited to one

25

00:02:16,610 --> 00:02:14,610

hour today's panelists are Mario Perez

26

00:02:18,800 --> 00:02:16,620

Kepler program scientists in the

27

00:02:20,590 --> 00:02:18,810

astrophysics division of NASA's science

28

00:02:22,940 --> 00:02:20,600

Mission Directorate in Washington DC

29

00:02:25,250 --> 00:02:22,950

Susan Thompson Kepler research

30

00:02:27,650 --> 00:02:25,260

scientists at the SETI Institute in

31

00:02:30,830 --> 00:02:27,660

Mountain View California and here at

32

00:02:33,140 --> 00:02:30,840

NASA Ames BJ Fulton doctoral candidate

33

00:02:34,819 --> 00:02:33,150

at the University of Hawaii in Manoa and

34

00:02:37,400 --> 00:02:34,829

at the California Institute of

35

00:02:39,800 --> 00:02:37,410

Technology or Caltech in Pasadena and

36

00:02:43,130 --> 00:02:39,810

finally we have Courtney dressing NASA

37

00:02:46,220 --> 00:02:43,140

Sagan fellow at Caltech so with that

38

00:02:48,620 --> 00:02:46,230

let's start it off Mario thanks Michelle

39

00:02:51,319 --> 00:02:48,630

it is indeed a pleasure to introduce

40

00:02:53,449 --> 00:02:51,329

this NASA capital release that describe

41

00:02:56,539 --> 00:02:53,459

the most recent result of the start of a

42

00:02:58,880 --> 00:02:56,549

catalog of planet candidates this Kepler

43

00:03:02,270 --> 00:02:58,890

candidate catalog contained the best

44

00:03:05,750 --> 00:03:02,280

measure and the most reliable data that

45

00:03:07,940 --> 00:03:05,760

we believe that could be planets from

46

00:03:12,110 --> 00:03:07,950

this new data will report today where

47

00:03:15,140 --> 00:03:12,120

there are 219 planet candidates which 10

48

00:03:17,630 --> 00:03:15,150

are possibly rocky and a habitable zone

49

00:03:19,400 --> 00:03:17,640

of their star which is a region of

50

00:03:21,710 --> 00:03:19,410

distances from a star where liquid

51
00:03:22,860 --> 00:03:21,720
liquid water might appear on the surface

52
00:03:26,369 --> 00:03:22,870
of rocky

53
00:03:28,309 --> 00:03:26,379
planet next line Kepler which is the

54
00:03:31,860 --> 00:03:28,319
first national mission capable of

55
00:03:34,170 --> 00:03:31,870
detecting earth-sized planet make the

56
00:03:36,780 --> 00:03:34,180
detection via the transit method which

57
00:03:39,600 --> 00:03:36,790
is photometric technique that measure

58
00:03:42,350 --> 00:03:39,610
the minuscule demon of starlight as a

59
00:03:45,960 --> 00:03:42,360
planet passes in front of its host star

60
00:03:49,860 --> 00:03:45,970
this motion is animated in this graphic

61
00:03:51,809 --> 00:03:49,870
this new result presented to a have

62
00:03:53,490 --> 00:03:51,819
implication for understanding the

63
00:03:56,250 --> 00:03:53,500

frequency of different types of planets

64

00:03:59,130 --> 00:03:56,260

in our galaxy and help us to advance our

65

00:03:59,640 --> 00:03:59,140

knowledge how planets are form next

66

00:04:02,369 --> 00:03:59,650

slide

67

00:04:04,650 --> 00:04:02,379

Kepler spent the first four years of

68

00:04:07,440 --> 00:04:04,660

this primary mission of serving one

69

00:04:09,869 --> 00:04:07,450

single star field located in the Cygnus

70

00:04:11,610 --> 00:04:09,879

constellation this new result of

71

00:04:14,190 --> 00:04:11,620

exoplanet presented to account from

72

00:04:17,129 --> 00:04:14,200

continuous observation of the signal

73

00:04:20,219 --> 00:04:17,139

field indicated on the left of this

74

00:04:23,310 --> 00:04:20,229

illustration Kepler keeps taking data

75

00:04:25,610 --> 00:04:23,320

today and for the last 40 years have

76

00:04:28,710 --> 00:04:25,620

been on a second mission named k2

77

00:04:31,379 --> 00:04:28,720

observing fields on the ecliptic plane

78

00:04:33,469 --> 00:04:31,389

of our galaxy next slide

79

00:04:37,080 --> 00:04:33,479

Kepler had been the most productive

80

00:04:40,080 --> 00:04:37,090

spacecraft in detecting exoplanet future

81

00:04:44,640 --> 00:04:40,090

mission like transiting exoplanet survey

82

00:04:46,770 --> 00:04:44,650

satellite or test launching in 2018 will

83

00:04:49,260 --> 00:04:46,780

detect new exoplanets around bright and

84

00:04:50,610 --> 00:04:49,270

nearby stars we have the same transit

85

00:04:54,360 --> 00:04:50,620

method used by Kepler

86

00:04:57,650 --> 00:04:54,370

lovely first launching in the mid 2020s

87

00:05:00,839 --> 00:04:57,660

will further contribute to discovery and

88

00:05:04,140 --> 00:05:00,849

characterization of exoplanet

89

00:05:08,430 --> 00:05:04,150

populations even beyond the kepler area

90

00:05:10,920 --> 00:05:08,440

NASA will continue to search for new

91

00:05:13,950 --> 00:05:10,930

worlds and for science of life beyond

92

00:05:16,920 --> 00:05:13,960

our solar system in summary including

93

00:05:20,640 --> 00:05:16,930

the new results announced today up to

94

00:05:23,010 --> 00:05:20,650

now Kepler has identified 4034 planet

95

00:05:24,450 --> 00:05:23,020

candidates Ward with the knowledge star

96

00:05:27,180 --> 00:05:24,460

and their two thousand and three hundred

97

00:05:29,180 --> 00:05:27,190

and thirty-five confirmed earth planet

98

00:05:32,190 --> 00:05:29,190

of all the planet candidates and

99

00:05:33,959 --> 00:05:32,200

confirmed exoplanet has discovered more

100

00:05:37,469 --> 00:05:33,969

than 80% of them

101
00:05:39,539 --> 00:05:37,479
Thanks thanks Mario joining us from the

102
00:05:41,699 --> 00:05:39,549
SETI Institute to tell us more about her

103
00:05:44,819 --> 00:05:41,709
work on the final Kepler candidate

104
00:05:47,129 --> 00:05:44,829
catalog is Susan Thompson Susan thank

105
00:05:49,469 --> 00:05:47,139
you Michelle I'm here today to announce

106
00:05:51,749 --> 00:05:49,479
the final Kepler survey catalog of

107
00:05:53,969 --> 00:05:51,759
planet candidates found from the Cygnus

108
00:05:56,639 --> 00:05:53,979
Field this is the first four years of

109
00:05:58,829 --> 00:05:56,649
data that Mario just talked about this

110
00:06:00,779 --> 00:05:58,839
is the last search that we performed and

111
00:06:03,059 --> 00:06:00,789
we used our most improved techniques and

112
00:06:05,249 --> 00:06:03,069
with that we found four thousand and

113
00:06:07,889 --> 00:06:05,259

thirty four candidates which include ten

114

00:06:10,979 --> 00:06:07,899

new terrestrial sized candidates in the

115

00:06:12,989 --> 00:06:10,989

habitable zone of their star this

116

00:06:15,089 --> 00:06:12,999

catalog is truly unique because for the

117

00:06:17,519 --> 00:06:15,099

first time we have characterized the

118

00:06:20,669 --> 00:06:17,529

catalog and as a result it allow us to

119

00:06:23,519 --> 00:06:20,679

do a direct survey of earth analogs in

120

00:06:26,399 --> 00:06:23,529

this part of the sky so we go to the

121

00:06:29,819 --> 00:06:26,409

first slide I'm plotting here our high

122

00:06:32,309 --> 00:06:29,829

confidence planet candidates along the

123

00:06:34,919 --> 00:06:32,319

x-axis you see the orbital period and

124

00:06:37,619 --> 00:06:34,929

along the y-axis you have the size of

125

00:06:40,049 --> 00:06:37,629

the planet relative to Earth on the

126

00:06:42,419 --> 00:06:40,059

there are three horizontal white lines

127

00:06:44,850 --> 00:06:42,429

showing the sizes of Jupiter Neptune and

128

00:06:46,319 --> 00:06:44,860

Earth for reference what you can see

129

00:06:48,949 --> 00:06:46,329

here is that most of the planets found

130

00:06:51,389 --> 00:06:48,959

by Kepler are smaller than Neptune and

131

00:06:52,979 --> 00:06:51,399

Kepler really truly has opened up our

132

00:06:56,399 --> 00:06:52,989

eyes to the existence of these small

133

00:06:59,279 --> 00:06:56,409

terrestrial sized worlds now if we go to

134

00:07:03,659 --> 00:06:59,289

the next slide I highlight the 219 new

135

00:07:05,519 --> 00:07:03,669

candidates found in this catalog most of

136

00:07:08,639 --> 00:07:05,529

them are small less than three Earth

137

00:07:11,359 --> 00:07:08,649

radii and several of them lie even out

138

00:07:13,469 --> 00:07:11,369

at long orbital periods near to the

139

00:07:16,979 --> 00:07:13,479

orbital period of the earth around the

140

00:07:18,689 --> 00:07:16,989

Sun however this last catalog we're

141

00:07:22,109 --> 00:07:18,699

turning our attention away from finding

142

00:07:24,149 --> 00:07:22,119

these new individual systems and towards

143

00:07:25,709 --> 00:07:24,159

trying to understand the demographics of

144

00:07:29,279 --> 00:07:25,719

these worlds that are most similar to

145

00:07:30,809 --> 00:07:29,289

our planet Earth to describe how we did

146

00:07:32,309 --> 00:07:30,819

that if you move to the next slide I

147

00:07:36,029 --> 00:07:32,319

need to tell you a little bit about how

148

00:07:39,059 --> 00:07:36,039

we go about doing our search using our

149

00:07:41,219 --> 00:07:39,069

most discerning software we search the

150

00:07:44,069 --> 00:07:41,229

two hundred thousand stars observed by

151
00:07:45,239 --> 00:07:44,079
Kepler this process is entirely

152
00:07:47,489 --> 00:07:45,249
automated and

153
00:07:49,799 --> 00:07:47,499
uniformly applied to all the data that

154
00:07:51,089 --> 00:07:49,809
is sent through through the pipeline

155
00:07:54,899 --> 00:07:51,099
which we're representing here with a

156
00:07:57,329 --> 00:07:54,909
simple blue triangle after we search the

157
00:08:00,059 --> 00:07:57,339
stars we found about 34,000 signals and

158
00:08:02,099 --> 00:08:00,069
these signals contain our transiting

159
00:08:04,049 --> 00:08:02,109
planets but they also contain a lot of

160
00:08:06,809 --> 00:08:04,059
noise either from the camera from the

161
00:08:09,539 --> 00:08:06,819
stars we then used a tool called the

162
00:08:12,119 --> 00:08:09,549
Robo Vetter to scrutinize each and every

163
00:08:14,729 --> 00:08:12,129

one of these signals in order to find

164

00:08:17,249 --> 00:08:14,739

the candidates the planet candidates

165

00:08:18,899 --> 00:08:17,259

which create the catalog so it found

166

00:08:20,850 --> 00:08:18,909

about 4000 candidates

167

00:08:24,479 --> 00:08:20,860

50 of which are terrestrial sized and in

168

00:08:25,529 --> 00:08:24,489

the hablas own of their star however we

169

00:08:27,509 --> 00:08:25,539

didn't stop there

170

00:08:29,219 --> 00:08:27,519

we needed to characterize our catalog

171

00:08:31,979 --> 00:08:29,229

and as a result we go to the next slide

172

00:08:34,379 --> 00:08:31,989

you see we injected simulated transits

173

00:08:36,929 --> 00:08:34,389

we put those to the same pipeline and we

174

00:08:38,879 --> 00:08:36,939

terminated how often we missed finding

175

00:08:41,249 --> 00:08:38,889

those particular transits and as a

176
00:08:44,400 --> 00:08:41,259
result we measured the undercount of our

177
00:08:46,860 --> 00:08:44,410
survey or the catalog completeness and

178
00:08:49,799 --> 00:08:46,870
then finally we also put through

179
00:08:52,590 --> 00:08:49,809
simulated noise on the next slide and

180
00:08:55,499 --> 00:08:52,600
you can see here that if we went through

181
00:08:58,679 --> 00:08:55,509
as we put the noise sir we counted how

182
00:09:00,660 --> 00:08:58,689
often we must took noise as a transit

183
00:09:02,429 --> 00:09:00,670
and as a result we measured the over

184
00:09:06,420 --> 00:09:02,439
count of our survey or the catalog

185
00:09:08,269 --> 00:09:06,430
reliability so if we go to the next

186
00:09:12,569 --> 00:09:08,279
slide

187
00:09:14,460 --> 00:09:12,579
we were able to we with this catalog we

188
00:09:15,840 --> 00:09:14,470

were able to even examine planets that

189

00:09:18,030 --> 00:09:15,850

were found in the habitable zone of

190

00:09:20,369 --> 00:09:18,040

their stars so plotted here are the

191

00:09:22,769 --> 00:09:20,379

confirmed planets that we have found in

192

00:09:26,040 --> 00:09:22,779

Kepler's habitable zone all of these are

193

00:09:28,379 --> 00:09:26,050

terrestrial size less than 1.8 times the

194

00:09:29,670 --> 00:09:28,389

size of the earth and lie in their

195

00:09:32,879 --> 00:09:29,680

Havel's own at least within their

196

00:09:34,829 --> 00:09:32,889

measured uncertainties along the x-axis

197

00:09:37,230 --> 00:09:34,839

you actually have the energy received by

198

00:09:38,970 --> 00:09:37,240

the planet so the warmer planets are on

199

00:09:41,790 --> 00:09:38,980

the left hand side they're closer to

200

00:09:44,069 --> 00:09:41,800

their star and along the x axis you have

201
00:09:45,900 --> 00:09:44,079
the temperature of the star with the

202
00:09:48,780 --> 00:09:45,910
cooler stars at the bottom and those

203
00:09:52,049 --> 00:09:48,790
stars most similar to our Sun at 5800

204
00:09:54,059 --> 00:09:52,059
Kelvin towards the top we show Venus

205
00:09:55,139 --> 00:09:54,069
Earth and Mars for reference and notice

206
00:09:56,759 --> 00:09:55,149
that the habitable zone which is

207
00:09:57,750 --> 00:09:56,769
highlighted in green runs from

208
00:10:03,180 --> 00:09:57,760
approximately

209
00:10:04,920 --> 00:10:03,190
Venus to Mars for sun-like stars because

210
00:10:09,000 --> 00:10:04,930
the habitable zone is much closer to

211
00:10:10,950 --> 00:10:09,010
these smaller cooler stars it's much

212
00:10:13,080 --> 00:10:10,960
easier to find those planets and that's

213
00:10:16,320 --> 00:10:13,090

why most of our confirmed planets around

214

00:10:18,030 --> 00:10:16,330

these small stars but now if we add in

215

00:10:21,900 --> 00:10:18,040

the candidates that were found in this

216

00:10:24,480 --> 00:10:21,910

catalog which are shown in yellow you

217

00:10:27,390 --> 00:10:24,490

can see that we fill in the population

218

00:10:29,940 --> 00:10:27,400

of planets around sun-like stars those

219

00:10:32,520 --> 00:10:29,950

at the top of the diagram for instance

220

00:10:34,020 --> 00:10:32,530

if we go to the next slide you can see

221

00:10:36,720 --> 00:10:34,030

the ones that are brand-new to this

222

00:10:39,120 --> 00:10:36,730

catalog and the closest Earth analog we

223

00:10:43,110 --> 00:10:39,130

have of these high-confidence candidates

224

00:10:44,670 --> 00:10:43,120

from this catalog is KY 7711 it is sits

225

00:10:46,950 --> 00:10:44,680

right next to the earth on this diagram

226

00:10:49,710 --> 00:10:46,960

meaning it receives just about the same

227

00:10:51,750 --> 00:10:49,720

amount of energy as we do from our Sun

228

00:10:57,630 --> 00:10:51,760

and it's only slightly larger than the

229

00:10:59,070 --> 00:10:57,640

earth at 1.3 Earth radii but what's also

230

00:11:01,080 --> 00:10:59,080

important besides finding these

231

00:11:03,780 --> 00:11:01,090

interesting new systems is that we have

232

00:11:05,580 --> 00:11:03,790

characterized how many planets we missed

233

00:11:08,850 --> 00:11:05,590

in this region and how many of these

234

00:11:11,310 --> 00:11:08,860

planets are likely due to noise and as a

235

00:11:13,680 --> 00:11:11,320

result we are able to extend the ability

236

00:11:16,050 --> 00:11:13,690

to do demographics from the Havel's own

237

00:11:20,370 --> 00:11:16,060

of just the smallest stars out to even

238

00:11:21,570 --> 00:11:20,380

those stars similar to the Sun so I will

239

00:11:24,890 --> 00:11:21,580

leave you with the last slide which

240

00:11:28,650 --> 00:11:24,900

again shows our planet candidates and

241

00:11:30,870 --> 00:11:28,660

point out that we have done this sort of

242

00:11:33,030 --> 00:11:30,880

demographics of exoplanets out at

243

00:11:34,830 --> 00:11:33,040

shorter periods but now with this

244

00:11:37,170 --> 00:11:34,840

catalog we're able to extend that out to

245

00:11:41,190 --> 00:11:37,180

the longest periods those periods that

246

00:11:44,850 --> 00:11:41,200

are most similar to our earth and so as

247

00:11:47,070 --> 00:11:44,860

a result this survey catalogue will be

248

00:11:49,380 --> 00:11:47,080

the foundation for directly answering

249

00:11:52,110 --> 00:11:49,390

one of astronomy's most compelling

250

00:11:55,470 --> 00:11:52,120

questions how many planets like our

251
00:11:59,070 --> 00:11:55,480
earth are actually in the galaxy thank

252
00:12:00,840 --> 00:11:59,080
you no thank you Susan now here to tell

253
00:12:02,790 --> 00:12:00,850
us about his work measuring the

254
00:12:05,700 --> 00:12:02,800
demographics of the smallest planets in

255
00:12:08,310 --> 00:12:05,710
the galaxy is BJ Fulton PJ Thank You

256
00:12:11,430 --> 00:12:08,320
Michelle yeah so I'm going to be sharing

257
00:12:13,050 --> 00:12:11,440
a very exciting result that was

258
00:12:15,210 --> 00:12:13,060
made possible thanks to the catalogues

259
00:12:17,760 --> 00:12:15,220
of thousands of kepler planets like the

260
00:12:19,410 --> 00:12:17,770
one the Susan just described we've just

261
00:12:21,930 --> 00:12:19,420
discovered that what we thought was a

262
00:12:24,270 --> 00:12:21,940
single type of planets is actually two

263
00:12:28,640 --> 00:12:24,280

distinct classes of planets with quite

264

00:12:33,480 --> 00:12:32,070

before our study the Kepler mission had

265

00:12:35,670 --> 00:12:33,490

already demonstrated that small planets

266

00:12:39,030 --> 00:12:35,680

between the size of Earth and Neptune

267

00:12:40,500 --> 00:12:39,040

are both common and diverse here I'm

268

00:12:42,690 --> 00:12:40,510

showing the number of planets per

269

00:12:45,690 --> 00:12:42,700

hundred stars for a range of different

270

00:12:47,340 --> 00:12:45,700

planet sizes on the left are planets the

271

00:12:49,560 --> 00:12:47,350

size of Earth and on the right are

272

00:12:51,420 --> 00:12:49,570

planets the size of Jupiter now you see

273

00:12:53,700 --> 00:12:51,430

at around four times the size of Earth

274

00:12:57,240 --> 00:12:53,710

or about the size of Neptune the number

275

00:12:58,340 --> 00:12:57,250

of planets shoots up drastically next

276

00:13:01,650 --> 00:12:58,350

slide please

277

00:13:04,170 --> 00:13:01,660

so in order to resolve fine details in

278

00:13:06,120 --> 00:13:04,180

the radius distribution of planets our

279

00:13:08,010 --> 00:13:06,130

team embarked on a five-year campaign

280

00:13:10,530 --> 00:13:08,020

with the Keck Observatory to

281

00:13:13,500 --> 00:13:10,540

characterize over 1300 stars known to

282

00:13:15,450 --> 00:13:13,510

host kepler planets since the transit

283

00:13:17,910 --> 00:13:15,460

technique used by coupler gives us a way

284

00:13:20,460 --> 00:13:17,920

to measure the Stars size rel the planet

285

00:13:23,100 --> 00:13:20,470

size relative to the Stars size by

286

00:13:24,510 --> 00:13:23,110

precisely measuring the stellar sizes we

287

00:13:27,810 --> 00:13:24,520

greatly enhanced our knowledge of the

288

00:13:30,420 --> 00:13:27,820

planets armed with the precise catalog

289

00:13:33,390 --> 00:13:30,430

of kepler planet sizes we examine the

290

00:13:35,100 --> 00:13:33,400

family tree of small planets kepler

291

00:13:37,140 --> 00:13:35,110

planets had appeared to span all sizes

292

00:13:40,320 --> 00:13:37,150

between one and four times the size of

293

00:13:42,480 --> 00:13:40,330

Earth but when measured precisely small

294

00:13:45,620 --> 00:13:42,490

planets design into two distinct size

295

00:13:47,820 --> 00:13:45,630

groups next slide please

296

00:13:50,400 --> 00:13:47,830

most of the planets in the first group

297

00:13:52,730 --> 00:13:50,410

may be akin to the earth with rocky

298

00:13:55,410 --> 00:13:52,740

surfaces and little to no atmospheres

299

00:13:58,079 --> 00:13:55,420

planets in the second group are probably

300

00:14:01,020 --> 00:13:58,089

more like cousins of Neptune's with

301
00:14:04,140 --> 00:14:01,030
thick atmospheres and no surface to

302
00:14:05,610 --> 00:14:04,150
speak of intermediate sized planets

303
00:14:08,400 --> 00:14:05,620
between these two size groups are

304
00:14:09,870 --> 00:14:08,410
relatively rare this is a major new

305
00:14:12,480 --> 00:14:09,880
division in the family tree of

306
00:14:14,550 --> 00:14:12,490
exoplanets somewhat analogous to the

307
00:14:18,390 --> 00:14:14,560
discovery that mammals and lizards are

308
00:14:20,070 --> 00:14:18,400
separate branches on the tree of life we

309
00:14:22,470 --> 00:14:20,080
can speculate as to why nature prefers

310
00:14:24,569 --> 00:14:22,480
to make small planets in these two sizes

311
00:14:27,460 --> 00:14:24,579
next slide please

312
00:14:28,689 --> 00:14:27,470
so the size of the planet is determined

313
00:14:30,100 --> 00:14:28,699

by the quantity and the type of

314

00:14:32,680 --> 00:14:30,110

materials that are gathered together

315

00:14:34,600 --> 00:14:32,690

during the planets formation planet

316

00:14:37,720 --> 00:14:34,610

sizes can also change with time if

317

00:14:39,999 --> 00:14:37,730

materials are stripped away the size of

318

00:14:42,040 --> 00:14:40,009

the planets in the first group suggests

319

00:14:44,860 --> 00:14:42,050

that Earth's like rocky planets can

320

00:14:47,559 --> 00:14:44,870

typically be no larger than about 75%

321

00:14:50,110 --> 00:14:47,569

bigger than the earth a very small

322

00:14:52,600 --> 00:14:50,120

amount of light hydrogen helium gases

323

00:14:55,679 --> 00:14:52,610

goes a long way to inflate the size of

324

00:14:58,329 --> 00:14:55,689

planets adding a tiny amount of hydrogen

325

00:15:00,999 --> 00:14:58,339

to one of these rocky planets say about

326

00:15:02,980 --> 00:15:01,009

two percent by mass would cause the

327

00:15:06,910 --> 00:15:02,990

planet to jump the gap and move into the

328

00:15:09,280 --> 00:15:06,920

group of larger planets planets need to

329

00:15:11,110 --> 00:15:09,290

have a very finely tuned amount of

330

00:15:13,480 --> 00:15:11,120

hydrogen helium to live right in the

331

00:15:16,509 --> 00:15:13,490

middle of that gap between about 0.1%

332

00:15:19,809 --> 00:15:16,519

and 1% of hydrogen helium and that just

333

00:15:21,610 --> 00:15:19,819

doesn't leave much wiggle room the gap

334

00:15:23,110 --> 00:15:21,620

between the two planet sizes also

335

00:15:25,900 --> 00:15:23,120

suggests that environment plays a

336

00:15:28,150 --> 00:15:25,910

decisive role the atmospheres of planets

337

00:15:30,129 --> 00:15:28,160

orbiting close to their host stars are

338

00:15:32,819 --> 00:15:30,139

susceptible to being blow-torched away

339

00:15:35,499 --> 00:15:32,829

by the extreme radiation from the star

340

00:15:37,629 --> 00:15:35,509

after millions of years the slightly

341

00:15:40,210 --> 00:15:37,639

larger gaseous planets that we see today

342

00:15:41,769 --> 00:15:40,220

either needed to start with very thick

343

00:15:44,110 --> 00:15:41,779

atmospheres that could survive the

344

00:15:45,730 --> 00:15:44,120

erosion or grow up in a more benign

345

00:15:50,019 --> 00:15:45,740

environment farther away from their host

346

00:15:51,280 --> 00:15:50,029

stars the few planets that may have

347

00:15:52,600 --> 00:15:51,290

started off right in the middle of that

348

00:15:55,300 --> 00:15:52,610

gap with just the right amount of

349

00:15:57,160 --> 00:15:55,310

hydrogen helium are prone to losing all

350

00:16:01,059 --> 00:15:57,170

of that hydrogen and then moving down

351

00:16:02,650 --> 00:16:01,069

into the class of smaller planets this

352

00:16:04,960 --> 00:16:02,660

result has significant implications for

353

00:16:06,249 --> 00:16:04,970

the search for life approximately half

354

00:16:09,100 --> 00:16:06,259

of the planets that we know are so

355

00:16:11,139 --> 00:16:09,110

common have no solid surface or a

356

00:16:13,240 --> 00:16:11,149

surface deep beneath the crushing weight

357

00:16:15,970 --> 00:16:13,250

of a thick atmospheres and these would

358

00:16:17,639 --> 00:16:15,980

not be nice places to live our result

359

00:16:19,929 --> 00:16:17,649

sharpens up the dividing line between

360

00:16:21,670 --> 00:16:19,939

potentially habitable planets and those

361

00:16:23,470 --> 00:16:21,680

are that are inhospitable to life as we

362

00:16:25,119 --> 00:16:23,480

know it thank you for your attention

363

00:16:27,819 --> 00:16:25,129

I'll give it back to Michelle Thank You

364

00:16:29,319 --> 00:16:27,829

Vijay and to share her perspective on

365

00:16:30,819 --> 00:16:29,329

the results from the Kepler mission that

366

00:16:33,009 --> 00:16:30,829

you've just heard about is Courtenay

367

00:16:35,110 --> 00:16:33,019

dressing from Caltech Courtney Thank You

368

00:16:36,060 --> 00:16:35,120

Michelle we've heard remarkable results

369

00:16:37,620 --> 00:16:36,070

today

370

00:16:40,320 --> 00:16:37,630

Susan Thompson we saw the latest

371

00:16:44,160 --> 00:16:40,330

catalogue of Kepler results that catalog

372

00:16:46,680 --> 00:16:44,170

of 4034 planets includes 219 new

373

00:16:49,770 --> 00:16:46,690

detection z' and 10 possibly habitable

374

00:16:52,590 --> 00:16:49,780

worlds from BJ Fulton we learned that

375

00:16:55,290 --> 00:16:52,600

planets with radii between 1.5 and 2

376

00:16:56,940 --> 00:16:55,300

Earth radii are scarce most planets are

377

00:16:58,680 --> 00:16:56,950

either larger than that number or

378

00:17:00,690 --> 00:16:58,690

smaller than that number they're either

379

00:17:03,240 --> 00:17:00,700

like the earth or like Neptune but not

380

00:17:05,400 --> 00:17:03,250

so much in between going to the next

381

00:17:07,620 --> 00:17:05,410

slide I want to take us back in time to

382

00:17:09,510 --> 00:17:07,630

2009 before the NASA Kepler mission

383

00:17:12,390 --> 00:17:09,520

launched this is what we knew about

384

00:17:14,550 --> 00:17:12,400

exoplanet populations back in 2009 on

385

00:17:16,260 --> 00:17:14,560

the left side of the plot you see the

386

00:17:19,290 --> 00:17:16,270

size of the planet relative to the earth

387

00:17:21,510 --> 00:17:19,300

the white horizontal lines indicate the

388

00:17:23,790 --> 00:17:21,520

sizes of Earth Neptune and Jupiter for

389

00:17:25,380 --> 00:17:23,800

scale on the bottom of the plot I'm

390

00:17:27,180 --> 00:17:25,390

showing you the orbital period of the

391

00:17:29,280 --> 00:17:27,190

planet or how long it takes it to go

392

00:17:30,990 --> 00:17:29,290

around its star what you see on this

393

00:17:33,180 --> 00:17:31,000

plot is that we knew about planets with

394

00:17:34,830 --> 00:17:33,190

a wide range of orbital periods but we

395

00:17:36,600 --> 00:17:34,840

didn't know a very many small planets

396

00:17:38,490 --> 00:17:36,610

most of the worlds on this plot are

397

00:17:41,790 --> 00:17:38,500

Jupiter sized maybe even if you are

398

00:17:44,610 --> 00:17:41,800

neptune-sized very few are small worlds

399

00:17:46,890 --> 00:17:44,620

like the earth advancing forward to

400

00:17:49,260 --> 00:17:46,900

after Kepler found planets we see on the

401
00:17:51,390 --> 00:17:49,270
next slide that there are now thousands

402
00:17:53,550 --> 00:17:51,400
of yellow dots these worlds were found

403
00:17:56,880 --> 00:17:53,560
by Kepler during its study of the Cygnus

404
00:17:58,980 --> 00:17:56,890
field from BJ we learned that population

405
00:18:01,410 --> 00:17:58,990
of yellow planets hovering between the

406
00:18:03,930 --> 00:18:01,420
earth line and the Neptune line actually

407
00:18:06,570 --> 00:18:03,940
divides nicely into two populations one

408
00:18:09,690 --> 00:18:06,580
smaller than 1.5 Earth radii and one

409
00:18:11,760 --> 00:18:09,700
larger than two Earth radii this sample

410
00:18:14,010 --> 00:18:11,770
of planets is quite unique and allows us

411
00:18:16,560 --> 00:18:14,020
to do sophisticated statistical studies

412
00:18:18,300 --> 00:18:16,570
as Susan pointed out this latest version

413
00:18:21,210 --> 00:18:18,310

of the Kepler catalog was found in a

414

00:18:23,490 --> 00:18:21,220

uniform way using sophisticated Robo

415

00:18:25,290 --> 00:18:23,500

vetting tools which means it can be used

416

00:18:27,420 --> 00:18:25,300

for statistical analyses to answer

417

00:18:29,970 --> 00:18:27,430

questions like how common is the earth

418

00:18:32,910 --> 00:18:29,980

in the galaxy and how many solar systems

419

00:18:35,070 --> 00:18:32,920

are like ours on the next slide I've

420

00:18:36,450 --> 00:18:35,080

highlighted several populations of

421

00:18:38,310 --> 00:18:36,460

planets that we've learned about from

422

00:18:40,500 --> 00:18:38,320

Kepler and other missions and surveys

423

00:18:42,630 --> 00:18:40,510

what we see here is different

424

00:18:44,700 --> 00:18:42,640

populations with different colored ovals

425

00:18:46,620 --> 00:18:44,710

on the top we have an oval in the top

426

00:18:48,120 --> 00:18:46,630

left for hot Jupiters worlds like

427

00:18:49,560 --> 00:18:48,130

Jupiter that are closer to their star

428

00:18:51,690 --> 00:18:49,570

than mercury is to the Sun

429

00:18:53,670 --> 00:18:51,700

on the top right we have another oval

430

00:18:55,710 --> 00:18:53,680

for cold gas giants those are worlds

431

00:18:58,290 --> 00:18:55,720

analogous to Jupiter in our own solar

432

00:19:00,180 --> 00:18:58,300

system below that we have the ocean

433

00:19:01,560 --> 00:19:00,190

world and ice giants these are the

434

00:19:03,780 --> 00:19:01,570

planets that are just on the other side

435

00:19:06,570 --> 00:19:03,790

of the gap that BJ Fulton described

436

00:19:08,550 --> 00:19:06,580

below that gap we have a large yellow

437

00:19:10,020 --> 00:19:08,560

oval showing all of the rocky planets

438

00:19:11,670 --> 00:19:10,030

that potentially could be like earth

439

00:19:13,830 --> 00:19:11,680

most of the ones shown on this diagram

440

00:19:15,690 --> 00:19:13,840

are probably hotter than the earth but

441

00:19:17,610 --> 00:19:15,700

the ones towards the right end might

442

00:19:20,220 --> 00:19:17,620

actually be cool places to live in the

443

00:19:22,200 --> 00:19:20,230

future the ones in the green oval are

444

00:19:24,150 --> 00:19:22,210

the lava worlds these planets are like

445

00:19:26,130 --> 00:19:24,160

Kepler 10b they're so close to their

446

00:19:28,140 --> 00:19:26,140

stars that their surfaces are covered in

447

00:19:30,840 --> 00:19:28,150

molten lava those would not be good

448

00:19:32,970 --> 00:19:30,850

places to live in the lower right corner

449

00:19:34,230 --> 00:19:32,980

of the plot we see the frontier this

450

00:19:36,900 --> 00:19:34,240

region does not have very many

451
00:19:38,670 --> 00:19:36,910
exoplanets in it we also see a region at

452
00:19:40,650 --> 00:19:38,680
the middle left of the plot that doesn't

453
00:19:42,360 --> 00:19:40,660
have any exoplanets but the reason for

454
00:19:44,580 --> 00:19:42,370
the absence of the planets notice -

455
00:19:46,920 --> 00:19:44,590
those two regions is different on the

456
00:19:48,990 --> 00:19:46,930
left side we don't see exoplanets there

457
00:19:50,610 --> 00:19:49,000
because they're quite rare in the lower

458
00:19:51,990 --> 00:19:50,620
right corner however we don't see

459
00:19:54,330 --> 00:19:52,000
exoplanets there because they're very

460
00:19:56,040 --> 00:19:54,340
difficult to find Kepler has been

461
00:19:58,200 --> 00:19:56,050
pushing the boundary of the frontier

462
00:20:00,150 --> 00:19:58,210
towards the right corner of the plot

463
00:20:01,950 --> 00:20:00,160

Kepler has pushed us towards smaller

464

00:20:04,200 --> 00:20:01,960

planets and planets some longer period

465

00:20:06,330 --> 00:20:04,210

orbits as we go forward towards the

466

00:20:09,390 --> 00:20:06,340

future that frontier will continue to

467

00:20:11,700 --> 00:20:09,400

advance on the next slide we see here

468

00:20:13,560 --> 00:20:11,710

the chart that Mario showed earlier this

469

00:20:16,200 --> 00:20:13,570

is the progress of NASA exoplanet

470

00:20:17,790 --> 00:20:16,210

missions through the decades here we're

471

00:20:21,000 --> 00:20:17,800

focusing today on the results of the

472

00:20:22,650 --> 00:20:21,010

NASA Kepler mission next year in 2018

473

00:20:24,930 --> 00:20:22,660

the transient exoplanet survey satellite

474

00:20:27,090 --> 00:20:24,940

will launch and begin detecting planets

475

00:20:28,980 --> 00:20:27,100

around bright stars bright stars are

476
00:20:30,570 --> 00:20:28,990
fantastic for planet detection because

477
00:20:32,400 --> 00:20:30,580
those stars are well suited for

478
00:20:34,080 --> 00:20:32,410
follow-up observations that could reveal

479
00:20:36,660 --> 00:20:34,090
the mass of the planet from the ground

480
00:20:38,670 --> 00:20:36,670
after tests will be able to characterize

481
00:20:41,160 --> 00:20:38,680
the atmospheres of planets using the

482
00:20:43,710 --> 00:20:41,170
James Webb Space Telescope and find even

483
00:20:46,140 --> 00:20:43,720
more planets with W first looking

484
00:20:48,510 --> 00:20:46,150
forward to the 2030s we can imagine the

485
00:20:50,640 --> 00:20:48,520
day where we actually take direct images

486
00:20:52,470 --> 00:20:50,650
of planets like the earth in the

487
00:20:54,360 --> 00:20:52,480
habitable zones of sun-like stars I

488
00:20:55,890 --> 00:20:54,370

can't wait to see the press conference

489

00:20:57,630 --> 00:20:55,900

that will occur once those missions are

490

00:20:59,450 --> 00:20:57,640

flying thank you very much

491

00:21:02,330 --> 00:20:59,460

Thank You Courtney I neither can

492

00:21:04,220 --> 00:21:02,340

I well let's turn to questions and

493

00:21:06,380 --> 00:21:04,230

answers now we have several reporters

494

00:21:08,779 --> 00:21:06,390

here in the live audience and a number

495

00:21:10,279 --> 00:21:08,789

of you on the phone as well and for

496

00:21:12,740 --> 00:21:10,289

those joining in on Twitter we're going

497

00:21:17,029 --> 00:21:12,750

to have you ask your question first with

498

00:21:18,830 --> 00:21:17,039

hashtag ask Kepler we with the number of

499

00:21:20,539 --> 00:21:18,840

folks queued up to ask questions we're

500

00:21:22,010 --> 00:21:20,549

going to give everyone a chance to ask

501
00:21:23,930 --> 00:21:22,020
one question and a follow up and then if

502
00:21:28,220 --> 00:21:23,940
time permits we'll go back and start

503
00:21:29,840 --> 00:21:28,230
again our operator will identify you by

504
00:21:32,330 --> 00:21:29,850
name but if not please give your name

505
00:21:35,659 --> 00:21:32,340
your media affiliation and direct your

506
00:21:39,460 --> 00:21:35,669
question to a panelist if possible for

507
00:21:42,139 --> 00:21:39,470
those dialing in please push star

508
00:21:45,680 --> 00:21:42,149
asterisk on your phone to get in the

509
00:21:47,779 --> 00:21:45,690
queue to ask a question and with that

510
00:21:51,560 --> 00:21:47,789
we'll look for questions here in the

511
00:21:53,120 --> 00:21:51,570
audience first and we have a mic coming

512
00:21:56,029 --> 00:21:53,130
to you right now right behind you

513
00:21:59,810 --> 00:21:56,039

thank you rob reynolds from al jazeera

514

00:22:03,760 --> 00:21:59,820

english so if you could break it down

515

00:22:06,649 --> 00:22:03,770

for the layman's audience how many

516

00:22:09,320 --> 00:22:06,659

planets have you discovered in total and

517

00:22:14,960 --> 00:22:09,330

how many of them are in this Goldilocks

518

00:22:21,310 --> 00:22:14,970

zone that that might support life and I

519

00:22:23,980 --> 00:22:21,320

have a follow-up question um excuse me

520

00:22:26,470 --> 00:22:23,990

with this sir your first question is how

521

00:22:30,460 --> 00:22:26,480

many we discovered in total yes Kepler

522

00:22:32,290 --> 00:22:30,470

is it has confirmed over 2300 planets

523

00:22:35,050 --> 00:22:32,300

and these are planets where there is no

524

00:22:37,720 --> 00:22:35,060

question at all that that signal is

525

00:22:39,550 --> 00:22:37,730

coming from an exoplanet when I'm

526

00:22:41,410 --> 00:22:39,560

presenting here today are candidates

527

00:22:44,110 --> 00:22:41,420

meaning there's still some room for

528

00:22:45,970 --> 00:22:44,120

doubt whether that signal is coming from

529

00:22:49,150 --> 00:22:45,980

a planet it could still be coming from

530

00:22:51,100 --> 00:22:49,160

other Astrophysical signals so this

531

00:22:52,780 --> 00:22:51,110

catalog though has four thousand and

532

00:22:55,570 --> 00:22:52,790

thirty four candidates and that's a

533

00:22:57,700 --> 00:22:55,580

pretty close number to the final Kepler

534

00:22:59,830 --> 00:22:57,710

candidates that will be found we may

535

00:23:01,600 --> 00:22:59,840

clean up a few more in the end and find

536

00:23:04,300 --> 00:23:01,610

a few more in the end but this catalog

537

00:23:06,130 --> 00:23:04,310

has four thousand and thirty four and in

538

00:23:08,020 --> 00:23:06,140

the Goldilocks zone we have

539

00:23:11,560 --> 00:23:08,030

approximately fifty that are in the

540

00:23:13,690 --> 00:23:11,570

Goldilocks zone my question is as I

541

00:23:17,170 --> 00:23:13,700

understand that Kepler is focusing on

542

00:23:18,460 --> 00:23:17,180

a very small well that was fifty

543

00:23:21,310 --> 00:23:18,470

terrestrial sized planets in that

544

00:23:23,620 --> 00:23:21,320

Goldilocks zone rest chill sized planets

545

00:23:25,270 --> 00:23:23,630

that are in the right right so small

546

00:23:29,380 --> 00:23:25,280

planets that are in the Goldilocks zone

547

00:23:32,940 --> 00:23:29,390

we have more litter they're larger that

548

00:23:36,190 --> 00:23:32,950

the the the telescope is focusing on a

549

00:23:41,020 --> 00:23:36,200

relatively small area in the Cygnus

550

00:23:42,820 --> 00:23:41,030

formation right so based on that and

551
00:23:46,770 --> 00:23:42,830
whatever statistical analysis you've

552
00:23:51,510 --> 00:23:46,780
been able to do how common are the

553
00:23:54,610 --> 00:23:51,520
potentially rocky in the right zone

554
00:23:55,360 --> 00:23:54,620
habitable zone planets in our whole

555
00:23:59,110 --> 00:23:55,370
galaxy

556
00:24:01,750 --> 00:23:59,120
any ideas so we still haven't done that

557
00:24:04,120 --> 00:24:01,760
analysis on this specific catalog

558
00:24:05,890 --> 00:24:04,130
according might want to address some of

559
00:24:06,790 --> 00:24:05,900
the other studies that have done been

560
00:24:09,760 --> 00:24:06,800
done previously

561
00:24:11,940 --> 00:24:09,770
sure for M dwarfs which are small stars

562
00:24:14,230 --> 00:24:11,950
that make up 75% of stars in the galaxy

563
00:24:16,150 --> 00:24:14,240

we know that one out of every four of

564

00:24:19,740 --> 00:24:16,160

them has a planet that is small and is

565

00:24:25,560 --> 00:24:23,610

oh maybe it means that it's not crazy

566

00:24:27,780 --> 00:24:25,570

that we found a planet in the habitable

567

00:24:30,570 --> 00:24:27,790

zone of the closest star to the Sun so

568

00:24:32,010 --> 00:24:30,580

Proxima Centauri B has a small planet in

569

00:24:33,480 --> 00:24:32,020

the habitable zone at least we think

570

00:24:34,770 --> 00:24:33,490

it's small it does not transit so we do

571

00:24:36,210 --> 00:24:34,780

not know the size the planet for sure

572

00:24:46,550 --> 00:24:36,220

but the mass measurements consistent

573

00:24:53,790 --> 00:24:50,640

sorry to prolong my question-and-answer

574

00:24:56,400 --> 00:24:53,800

period but how close is close in terms

575

00:24:59,280 --> 00:24:56,410

of light-years just a couple just

576
00:25:01,620 --> 00:24:59,290
throughout the lore right next door and

577
00:25:03,480 --> 00:25:01,630
there could be life on it we'll have to

578
00:25:04,770 --> 00:25:03,490
find out it's something we could try to

579
00:25:08,040 --> 00:25:04,780
do with the next generation of

580
00:25:08,660 --> 00:25:08,050
ground-based large telescopes all right

581
00:25:10,800 --> 00:25:08,670
thank you

582
00:25:14,400 --> 00:25:10,810
we have another question here we'll

583
00:25:17,220 --> 00:25:14,410
bring a mic to you hi Allison Hawks from

584
00:25:18,990 --> 00:25:17,230
astrobiology magazine just want to know

585
00:25:20,880 --> 00:25:19,000
about tidally locked planets and if

586
00:25:22,170 --> 00:25:20,890
you've been able to understand a little

587
00:25:23,700 --> 00:25:22,180
bit about you know which of these

588
00:25:25,260 --> 00:25:23,710

terrestrial planets might be tightly

589

00:25:30,440 --> 00:25:25,270

locked and what the implications then

590

00:25:33,030 --> 00:25:30,450

are for habitability in those cases

591

00:25:34,680 --> 00:25:33,040

planets around low-mass stars tend to

592

00:25:35,940 --> 00:25:34,690

fall within the tidal locking radius

593

00:25:37,350 --> 00:25:35,950

because they're so close to the star you

594

00:25:39,000 --> 00:25:37,360

might expect them to be like the moon

595

00:25:41,010 --> 00:25:39,010

with one side always facing the star

596

00:25:42,390 --> 00:25:41,020

back in the day people thought that

597

00:25:43,920 --> 00:25:42,400

would be bad for life because the

598

00:25:45,540 --> 00:25:43,930

atmosphere could freeze out if one side

599

00:25:47,220 --> 00:25:45,550

of the planet was very cold more

600

00:25:48,570 --> 00:25:47,230

sophisticated three-dimensional models

601
00:25:50,070 --> 00:25:48,580
have revealed that if the planet has a

602
00:25:52,260 --> 00:25:50,080
bit of an atmosphere it probably would

603
00:25:54,120 --> 00:25:52,270
stay warm enough to remain hospitable to

604
00:25:55,770 --> 00:25:54,130
life and there's a chance then that you

605
00:25:57,270 --> 00:25:55,780
could have a bunch of civilizations

606
00:25:58,530 --> 00:25:57,280
where maybe all the astronomers live on

607
00:26:00,180 --> 00:25:58,540
one side of the planet and everyone else

608
00:26:04,620 --> 00:26:00,190
enjoys the Sun side on the beachy side

609
00:26:06,510 --> 00:26:04,630
close to the star all right let's take

610
00:26:10,860 --> 00:26:06,520
hope questions from the phone line

611
00:26:16,539 --> 00:26:14,009
The Associated Press your line is open

612
00:26:19,000 --> 00:26:16,549
yes thank you I have one question and

613
00:26:22,180 --> 00:26:19,010

then a follow-up let's look at these new

614

00:26:24,970 --> 00:26:22,190

planets the 219 new planet candidates

615

00:26:29,019 --> 00:26:24,980

and the ten roughly earth sized ones in

616

00:26:32,380 --> 00:26:29,029

the habitable zone am i right in hearing

617

00:26:33,820 --> 00:26:32,390

that those ten are in some ways

618

00:26:35,620 --> 00:26:33,830

different than many of the other ones

619

00:26:40,060 --> 00:26:35,630

because they're almost are most of them

620

00:26:42,730 --> 00:26:40,070

sort of uh more G Dwarfs like the Sun

621

00:26:45,730 --> 00:26:42,740

instead of the M dwarfs I mean in other

622

00:26:48,879 --> 00:26:45,740

words are these ten how many of them are

623

00:26:50,649 --> 00:26:48,889

are sort of more earth analog II and R

624

00:26:52,419 --> 00:26:50,659

does that make them more important and

625

00:26:56,350 --> 00:26:52,429

what does that mean and then I'll have a

626
00:26:59,620 --> 00:26:56,360
follow-up you're asking about the ten

627
00:27:01,570 --> 00:26:59,630
planets that are around the in the

628
00:27:05,139 --> 00:27:01,580
habitable zone and those that are near

629
00:27:07,330 --> 00:27:05,149
the that orbit a star similar to our Sun

630
00:27:09,549 --> 00:27:07,340
the thing about stars similar to our Sun

631
00:27:12,129 --> 00:27:09,559
they're not nearly as active as those

632
00:27:13,870 --> 00:27:12,139
that are around M dwarfs and Kortney

633
00:27:15,850 --> 00:27:13,880
probably could talk more about that and

634
00:27:18,430 --> 00:27:15,860
as a result you know we know that there

635
00:27:20,320 --> 00:27:18,440
is life on planets around G drawers we

636
00:27:23,350 --> 00:27:20,330
have it here and so that's partly why we

637
00:27:25,720 --> 00:27:23,360
focus in on looking for planets that are

638
00:27:29,590 --> 00:27:25,730

in the habitable zone of g-type stars or

639

00:27:32,049 --> 00:27:29,600

our sun-like stars sorry I to remember

640

00:27:33,610 --> 00:27:32,059

the rest of that question so so that is

641

00:27:35,680 --> 00:27:33,620

what's unique about those new ones that

642

00:27:37,509 --> 00:27:35,690

are found what is also unique is that I

643

00:27:40,120 --> 00:27:37,519

can tell you with high confidence that

644

00:27:42,940 --> 00:27:40,130

those are really signals and our data

645

00:27:45,730 --> 00:27:42,950

that they're truly Astrophysical unlike

646

00:27:46,950 --> 00:27:45,740

some of the other candidates we've

647

00:27:49,010 --> 00:27:46,960

released

648

00:27:52,519 --> 00:27:49,020

thank you

649

00:27:55,460 --> 00:27:52,529

did you have a follow-up yes okay and

650

00:27:57,950 --> 00:27:55,470

one of them is how many of those 10 RTG

651
00:28:01,039 --> 00:27:57,960
wars are they all and then what I know

652
00:28:02,659 --> 00:28:01,049
you haven't done the overall census

653
00:28:04,789 --> 00:28:02,669
demographic issue but that's sort of

654
00:28:08,330 --> 00:28:04,799
what Kepler was sold to the American

655
00:28:10,039 --> 00:28:08,340
public as as it is a demographic so can

656
00:28:11,950 --> 00:28:10,049
you give us I mean just looking at the

657
00:28:14,899 --> 00:28:11,960
math it looks like one out of eighty

658
00:28:16,789 --> 00:28:14,909
stars you know what out of eighty

659
00:28:19,820 --> 00:28:16,799
planets are in that you know beautiful

660
00:28:21,560 --> 00:28:19,830
small enough habitable zone is that

661
00:28:23,480 --> 00:28:21,570
about a good number and is there a

662
00:28:27,700 --> 00:28:23,490
better is there a number for G dwarfs

663
00:28:31,460 --> 00:28:27,710

Courtney gave us four endures thank you

664

00:28:34,220 --> 00:28:31,470

there is no official agreed-upon answer

665

00:28:36,380 --> 00:28:34,230

for terrestrial sized planets in the

666

00:28:37,820 --> 00:28:36,390

Goldilocks zone of G Dwarf stars this is

667

00:28:39,289 --> 00:28:37,830

a question that scientists will be

668

00:28:42,380 --> 00:28:39,299

working on over the next couple of years

669

00:28:44,180 --> 00:28:42,390

especially using this catalog what your

670

00:28:46,340 --> 00:28:44,190

ask your first question was the number

671

00:28:49,190 --> 00:28:46,350

of the new terrestrial sized planets

672

00:28:52,310 --> 00:28:49,200

that are in around G Dwarfs I'd have to

673

00:28:55,279 --> 00:28:52,320

go back to that slide to count but there

674

00:28:56,750 --> 00:28:55,289

are total total of ten candidates in

675

00:28:59,659 --> 00:28:56,760

total around G drawers in this new

676
00:29:01,639 --> 00:28:59,669
catalogue if I remember correctly but

677
00:29:03,289 --> 00:29:01,649
Carney address that I'd like to chime in

678
00:29:05,060 --> 00:29:03,299
and say that the reason why I'm so

679
00:29:07,460 --> 00:29:05,070
excited about Susan's results is that

680
00:29:10,250 --> 00:29:07,470
this catalog because it was done in such

681
00:29:11,870 --> 00:29:10,260
a sophisticated methodical way really

682
00:29:13,669 --> 00:29:11,880
enables those studies of habitable zone

683
00:29:15,139 --> 00:29:13,679
planet occurrence for sun-like stars in

684
00:29:17,000 --> 00:29:15,149
the way that previous catalogs did not

685
00:29:18,740 --> 00:29:17,010
so this is a remarkable step forward and

686
00:29:19,850 --> 00:29:18,750
our understanding of the frequency of

687
00:29:21,799 --> 00:29:19,860
terrestrial planets in the habitable

688
00:29:26,149 --> 00:29:21,809

zones of sun-like stars playing the

689

00:29:27,860 --> 00:29:26,159

fundamental groundwork built a number of

690

00:29:30,560 --> 00:29:27,870

the ten I'd like someone to follow up

691

00:29:33,470 --> 00:29:30,570

with that so if I remember correctly I

692

00:29:35,539 --> 00:29:33,480

think this is Seth there's a little less

693

00:29:38,230 --> 00:29:35,549

than half of them that are around g-type

694

00:29:40,010 --> 00:29:38,240

stars less than half of those ten

695

00:29:43,310 --> 00:29:40,020

alright let's take the next question

696

00:29:44,680 --> 00:29:43,320

from the phone the next question is

697

00:29:49,950 --> 00:29:44,690

coming from

698

00:29:51,960 --> 00:29:49,960

besa Grossman of your line is open

699

00:29:55,560 --> 00:29:51,970

I thank you for taking that question

700

00:29:57,029 --> 00:29:55,570

this is for BJ I was wondering if you

701

00:29:59,419 --> 00:29:57,039

could talk a little bit more about how

702

00:30:02,450 --> 00:29:59,429

you know that the neptune-like planets

703

00:30:07,350 --> 00:30:02,460

probably don't have a surface and then

704

00:30:08,880 --> 00:30:07,360

what the possible message for formation

705

00:30:11,850 --> 00:30:08,890

for these planets are and if there's

706

00:30:13,470 --> 00:30:11,860

something about their early histories if

707

00:30:16,980 --> 00:30:13,480

we can tell anything about what makes a

708

00:30:21,600 --> 00:30:16,990

solar system produce an earth-like

709

00:30:23,220 --> 00:30:21,610

planet or a mini Neptune yeah so we we

710

00:30:25,200 --> 00:30:23,230

think that we can tell the difference

711

00:30:27,779 --> 00:30:25,210

between the rocky group and the the mini

712

00:30:30,029 --> 00:30:27,789

Neptune group based on a few other lines

713

00:30:32,190 --> 00:30:30,039

of evidence in addition to the work we

714

00:30:33,810 --> 00:30:32,200

did if you look at planets that are

715

00:30:35,880 --> 00:30:33,820

orbiting very very close to their host

716

00:30:38,370 --> 00:30:35,890

stars with orbital periods less than

717

00:30:39,990 --> 00:30:38,380

about one day those things could not

718

00:30:41,519 --> 00:30:40,000

have any atmospheres at all they must

719

00:30:43,110 --> 00:30:41,529

have been blasted away and we can see

720

00:30:45,750 --> 00:30:43,120

that those planets get no larger than

721

00:30:48,060 --> 00:30:45,760

about one point seven if you go and

722

00:30:50,370 --> 00:30:48,070

measure the masses of a lot of planets

723

00:30:52,740 --> 00:30:50,380

in the Kepler field you can see that

724

00:30:53,880 --> 00:30:52,750

typically planets larger than about 1.6

725

00:30:56,010 --> 00:30:53,890

times the radius of Earth are

726

00:30:57,450 --> 00:30:56,020

low-density neptune-like planets and

727

00:31:00,269 --> 00:30:57,460

planets smaller than that or

728

00:31:01,799 --> 00:31:00,279

high-density and then with this gap is

729

00:31:03,870 --> 00:31:01,809

just another line of evidence that

730

00:31:07,200 --> 00:31:03,880

supports this idea that you have these

731

00:31:08,430 --> 00:31:07,210

two different groups of planets because

732

00:31:12,029 --> 00:31:08,440

I'm sorry could you repeat that a second

733

00:31:14,639 --> 00:31:12,039

part your question sure it was about how

734

00:31:16,470 --> 00:31:14,649

these planets develop and if there's a

735

00:31:18,000 --> 00:31:16,480

way to tell which stars are likely to

736

00:31:20,220 --> 00:31:18,010

produce Neptune's and which ones are

737

00:31:22,049 --> 00:31:20,230

likely to produce the Earth's or if we

738

00:31:25,350 --> 00:31:22,059

know anything about the condition lead

739

00:31:29,580 --> 00:31:25,360

to one or the other right so we don't

740

00:31:31,560 --> 00:31:29,590

really know but our best idea is that we

741

00:31:33,779 --> 00:31:31,570

we had a population of planets that all

742

00:31:35,970 --> 00:31:33,789

start with somewhere between one and ten

743

00:31:38,669 --> 00:31:35,980

percent of hydrogen helium gases so they

744

00:31:40,850 --> 00:31:38,679

form they all sort of have a range of

745

00:31:43,830 --> 00:31:40,860

various core sizes and a range of

746

00:31:45,480 --> 00:31:43,840

atmospheric sizes then when these

747

00:31:47,159 --> 00:31:45,490

planets and the ones that I'm studying

748

00:31:48,570 --> 00:31:47,169

are all orbiting relatively close to

749

00:31:51,029 --> 00:31:48,580

their star with orbital period shorter

750

00:31:52,260 --> 00:31:51,039

than 100 days and we think when those

751
00:31:53,970 --> 00:31:52,270
are exposed to the stellar radiation

752
00:31:56,039 --> 00:31:53,980
when you have this this continuous

753
00:31:59,010 --> 00:31:56,049
population and you expose it to that

754
00:32:00,960 --> 00:31:59,020
radiation over many years that tends to

755
00:32:03,090 --> 00:32:00,970
separate them into these two classes the

756
00:32:04,710 --> 00:32:03,100
ones that started a little bit larger or

757
00:32:06,060 --> 00:32:04,720
we'll hang on to their atmospheres and

758
00:32:07,260 --> 00:32:06,070
they're the ones to end up as many

759
00:32:09,450 --> 00:32:07,270
Neptune's and the ones that start a

760
00:32:11,669 --> 00:32:09,460
little bit smaller and/or had a little

761
00:32:13,169 --> 00:32:11,679
bit less hydrogen helium to start with

762
00:32:17,340 --> 00:32:13,179
end up in the small rocky planets

763
00:32:19,950 --> 00:32:17,350

because their atmospheres get lost thank

764

00:32:23,039 --> 00:32:19,960

you great we have another question on

765

00:32:24,260 --> 00:32:23,049

line we would fo nice calm your line is

766

00:32:28,140 --> 00:32:24,270

open

767

00:32:30,029 --> 00:32:28,150

hi so this is a final catalog from the

768

00:32:31,860 --> 00:32:30,039

first Kepler mission but what can data

769

00:32:33,270 --> 00:32:31,870

you've been getting from the k2 mission

770

00:32:38,190 --> 00:32:33,280

which looks at other parts of the sky

771

00:32:39,659 --> 00:32:38,200

bring to these statistics I'm part of a

772

00:32:41,460 --> 00:32:39,669

team that's currently trying to do that

773

00:32:42,870 --> 00:32:41,470

to use the k2 catalog to measure the

774

00:32:44,250 --> 00:32:42,880

frequencies of planets of different

775

00:32:46,260 --> 00:32:44,260

types and one of the great things about

776

00:32:47,970 --> 00:32:46,270

the k2 catalog is that because it's

777

00:32:50,130 --> 00:32:47,980

covering a wide range of the sky and

778

00:32:51,240 --> 00:32:50,140

includes many clusters of various ages

779

00:32:53,640 --> 00:32:51,250

so you could study planet information

780

00:32:55,230 --> 00:32:53,650

through time and it includes many stars

781

00:32:56,909 --> 00:32:55,240

with different metallicity and iron

782

00:32:59,100 --> 00:32:56,919

content so you can study the role of

783

00:33:00,960 --> 00:32:59,110

different initial starting conditions on

784

00:33:03,600 --> 00:33:00,970

the planet properties and it also

785

00:33:05,220 --> 00:33:03,610

contains many more low mass stars in the

786

00:33:06,870 --> 00:33:05,230

main Kepler mission and because I'm very

787

00:33:09,149 --> 00:33:06,880

interested in low mass stars I'm quite

788

00:33:11,310 --> 00:33:09,159

excited in what k2 can tell us about the

789

00:33:14,340 --> 00:33:11,320

frequency of planets at the small end of

790

00:33:17,010 --> 00:33:14,350

the stellar mass spectrum I'll just

791

00:33:19,020 --> 00:33:17,020

added k2 not only gives you a much more

792

00:33:20,730 --> 00:33:19,030

of a variety of different stellar types

793

00:33:22,560 --> 00:33:20,740

but it also gets to probe different

794

00:33:24,960 --> 00:33:22,570

regions of the galaxy so we could

795

00:33:26,279 --> 00:33:24,970

potentially see if the statistics that

796

00:33:28,020 --> 00:33:26,289

we're learning about the kepler field

797

00:33:33,600 --> 00:33:28,030

are different in the different parts of

798

00:33:36,539 --> 00:33:33,610

the galaxy alright we have one more

799

00:33:38,789 --> 00:33:36,549

question on the line Oh a next question

800

00:33:40,130 --> 00:33:38,799

is coming from Irene Klotz up Reuters

801

00:33:42,810 --> 00:33:40,140

your line is open

802

00:33:44,399 --> 00:33:42,820

thanks very much I have two quick

803

00:33:46,350 --> 00:33:44,409

questions and then probably a little

804

00:33:48,899 --> 00:33:46,360

longer one first one I just wanted to

805

00:33:53,909 --> 00:33:48,909

make sure that when you said initially

806

00:33:58,169 --> 00:33:53,919

that the just these data completes the

807

00:34:00,450 --> 00:33:58,179

Kepler candidate list just to

808

00:34:02,789 --> 00:34:00,460

double-check that that is not going to

809

00:34:04,970 --> 00:34:02,799

include any other data coming from k2

810

00:34:08,190 --> 00:34:04,980

you're treating these as separate

811

00:34:10,320 --> 00:34:08,200

missions and this data will complete the

812

00:34:13,139 --> 00:34:10,330

Kepler original mission and then the

813

00:34:15,669 --> 00:34:13,149

second quick one is about for BJ are

814

00:34:17,799 --> 00:34:15,679

there any proposed name

815

00:34:20,740 --> 00:34:17,809

for these classifications of planets

816

00:34:23,079 --> 00:34:20,750

besides earth-like or mini Neptune and

817

00:34:26,079 --> 00:34:23,089

then I have one other one I think my

818

00:34:28,270 --> 00:34:26,089

answers short I yes this is the last of

819

00:34:30,819 --> 00:34:28,280

the catalogs for k2 are completely

820

00:34:33,339 --> 00:34:30,829

separate from Kepler and so this is the

821

00:34:35,319 --> 00:34:33,349

last time we were searching the data for

822

00:34:39,220 --> 00:34:35,329

candidates from the Kepler come from the

823

00:34:40,990 --> 00:34:39,230

original Kepler mission as far as the

824

00:34:42,940 --> 00:34:41,000

names yeah we've been going with many

825

00:34:45,760 --> 00:34:42,950

earths and our mini Neptune z-- and

826

00:34:47,169 --> 00:34:45,770

super Earths lately we had thought they

827

00:34:48,730 --> 00:34:47,179

were sort of all super Earths and it was

828

00:34:50,950 --> 00:34:48,740

difficult to determine which ones may

829

00:34:53,379 --> 00:34:50,960

have gassen and which ones might have

830

00:34:55,990 --> 00:34:53,389

rocky surfaces but now we have a clear

831

00:34:57,910 --> 00:34:56,000

distinction between the two thanks and

832

00:35:01,630 --> 00:34:57,920

I'm also either for you Vijay or for

833

00:35:04,450 --> 00:35:01,640

Courtney why do you think that our solar

834

00:35:08,049 --> 00:35:04,460

system does not have any mini Neptune

835

00:35:14,319 --> 00:35:08,059

and is there any reason to think that it

836

00:35:15,190 --> 00:35:14,329

might have at one time that's a good

837

00:35:16,900 --> 00:35:15,200

question

838

00:35:18,430 --> 00:35:16,910

it is interesting that we don't have

839

00:35:20,710 --> 00:35:18,440

what appears to be the most common type

840

00:35:23,319 --> 00:35:20,720

of planet in the galaxy although you may

841

00:35:25,089 --> 00:35:23,329

have heard about recent result of this

842

00:35:27,460 --> 00:35:25,099

potential planet that's far out in the

843

00:35:30,640 --> 00:35:27,470

outer reaches of the solar system called

844

00:35:32,440 --> 00:35:30,650

planet 9 that one is potentially one of

845

00:35:36,730 --> 00:35:32,450

these the super Earths or mini Neptune's

846

00:35:38,620 --> 00:35:36,740

so it may answer that question planet 9

847

00:35:40,089 --> 00:35:38,630

isn't yet confirmed correct no that's

848

00:35:41,140 --> 00:35:40,099

not yet confirmed but all right people

849

00:35:43,120 --> 00:35:41,150

right across the hall from me are

850

00:35:44,309 --> 00:35:43,130

working hard to do just that very good

851
00:35:46,690 --> 00:35:44,319
very good

852
00:35:47,890 --> 00:35:46,700
all right I just want to remind folks in

853
00:35:50,490 --> 00:35:47,900
the live audience here if you have a

854
00:35:53,049 --> 00:35:50,500
question we'll bring a microphone to you

855
00:35:54,039 --> 00:35:53,059
and while we're doing that we will go

856
00:35:56,740 --> 00:35:54,049
back to the phone we have one more

857
00:35:58,530 --> 00:35:56,750
question as a board seen The Associated

858
00:36:03,130 --> 00:35:58,540
Press your line is open

859
00:36:07,960 --> 00:36:03,140
yes just two follow-ups one in you guys

860
00:36:11,470 --> 00:36:07,970
said 50 a round 50 habitable zones

861
00:36:15,160 --> 00:36:11,480
smaller total in the in they or roughly

862
00:36:18,579 --> 00:36:15,170
50 in the total isn't there an exact

863
00:36:20,829 --> 00:36:18,589

number I mean roughly could be 45 and or

864

00:36:22,780 --> 00:36:20,839

55 don't you have an exact number and

865

00:36:23,380 --> 00:36:22,790

second just to put this all in

866

00:36:25,630 --> 00:36:23,390

perspective

867

00:36:27,520 --> 00:36:25,640

Kepler's looked at a small part of the

868

00:36:29,460 --> 00:36:27,530

galaxy and distant part of the galaxy

869

00:36:31,650 --> 00:36:29,470

can you help us to

870

00:36:33,270 --> 00:36:31,660

you know look at even the bigger picture

871

00:36:36,060 --> 00:36:33,280

like saying cat you're looking at maybe

872

00:36:38,400 --> 00:36:36,070

one one-thousandth of the galaxy so if

873

00:36:40,800 --> 00:36:38,410

we wanted to take a get a get good sense

874

00:36:45,420 --> 00:36:40,810

of the rest of the galaxy multiply it by

875

00:36:48,720 --> 00:36:45,430

what in other words thank you so I'll

876

00:36:52,170 --> 00:36:48,730

just the first question we found we have

877

00:36:54,210 --> 00:36:52,180

50 hi confident we have 49 actually high

878

00:36:56,580 --> 00:36:54,220

confidence planet candidates in the

879

00:37:00,089 --> 00:36:56,590

hallowe zone that are less than 1.8

880

00:37:03,120 --> 00:37:00,099

Earth radii the catalog actually goes a

881

00:37:04,770 --> 00:37:03,130

bit deeper but these candidates start to

882

00:37:07,050 --> 00:37:04,780

become a little less reliable so we

883

00:37:09,150 --> 00:37:07,060

didn't want to present them here so you

884

00:37:11,730 --> 00:37:09,160

wouldn't see them as because they're not

885

00:37:16,170 --> 00:37:11,740

as confirmed or as validated as those

886

00:37:18,000 --> 00:37:16,180

others are so I would go the number it's

887

00:37:20,550 --> 00:37:18,010

49 that we showed on that plot that you

888

00:37:24,260 --> 00:37:20,560

were looking at in terms of the fraction

889

00:37:27,170 --> 00:37:24,270

when do you have a better idea that math

890

00:37:30,510 --> 00:37:27,180

square degrees rates 100 square degrees

891

00:37:35,310 --> 00:37:30,520

so 200,000 stars is all we actually

892

00:37:38,339 --> 00:37:35,320

looked at though okay can I answer that

893

00:37:40,829 --> 00:37:38,349

not the kepler field and sub

894

00:37:45,240 --> 00:37:40,839

approximately 115 degrees square and

895

00:37:48,089 --> 00:37:45,250

that's about 0.25 percent of the sky so

896

00:37:50,070 --> 00:37:48,099

in fact you need 400 Kepler's to cover

897

00:37:53,240 --> 00:37:50,080

the whole sky so that's the question

898

00:37:56,760 --> 00:37:53,250

that if we if we assume the statistic

899

00:37:59,940 --> 00:37:56,770

the signals field and all the field that

900

00:38:04,290 --> 00:37:59,950

K to observe our median and we can

901
00:38:08,270 --> 00:38:04,300
multiply 4 by 400 to get a sense of what

902
00:38:10,290 --> 00:38:08,280
the whole universe or galaxies around

903
00:38:12,780 --> 00:38:10,300
part of the galaxies are we observing

904
00:38:16,370 --> 00:38:12,790
but we haven't done that this is very

905
00:38:20,849 --> 00:38:16,380
recent information that was released

906
00:38:22,560 --> 00:38:20,859
this morning so I'm sure there will be a

907
00:38:24,570 --> 00:38:22,570
lot of people that will study the planet

908
00:38:26,160 --> 00:38:24,580
demographic based on with the

909
00:38:29,400 --> 00:38:26,170
information on this catalog in the

910
00:38:30,660 --> 00:38:29,410
future look at the results the

911
00:38:32,730 --> 00:38:30,670
transiting exoplanet survey satellite

912
00:38:34,740 --> 00:38:32,740
mission which will cover almost the full

913
00:38:37,050 --> 00:38:34,750

sky that has four cameras each of which

914

00:38:39,030 --> 00:38:37,060

has a field of view 27 by 27 degrees

915

00:38:40,339 --> 00:38:39,040

most those stars will only be observed

916

00:38:41,809 --> 00:38:40,349

for 27 days

917

00:38:43,729 --> 00:38:41,819

but some of them will be observed for up

918

00:38:45,469 --> 00:38:43,739

to almost a full year so we can then

919

00:38:47,029 --> 00:38:45,479

cross compare what we see with tests for

920

00:38:49,190 --> 00:38:47,039

short period with planets with what we

921

00:38:50,989 --> 00:38:49,200

see from Kepler and really check to see

922

00:38:53,989 --> 00:38:50,999

how planet properties vary across the

923

00:38:55,969 --> 00:38:53,999

full sky I'll just add that one problem

924

00:38:57,440 --> 00:38:55,979

with with sticking to a real strict

925

00:38:58,910 --> 00:38:57,450

number of the number of planets in the

926
00:39:00,979 --> 00:38:58,920
habitable zone is that these boundaries

927
00:39:02,989 --> 00:39:00,989
are all very fuzzy the actual boundaries

928
00:39:05,960 --> 00:39:02,999
of the habitable zone at the inner and

929
00:39:07,849 --> 00:39:05,970
outer edge are not that well-known and

930
00:39:10,190 --> 00:39:07,859
even if they are very well known there's

931
00:39:13,339 --> 00:39:10,200
a range it's it's not a sharp boundary

932
00:39:15,999 --> 00:39:13,349
it's fuzzy and in terms of multiplying

933
00:39:18,799 --> 00:39:16,009
that out to the galaxy those 50 are

934
00:39:20,719 --> 00:39:18,809
transiting planets right and and there's

935
00:39:23,180 --> 00:39:20,729
a big difference in transiting and

936
00:39:24,710 --> 00:39:23,190
actual of the intrinsic population right

937
00:39:25,789 --> 00:39:24,720
for a planet like the earth and the

938
00:39:28,039 --> 00:39:25,799

habitable zone of a star like the Sun

939

00:39:31,789 --> 00:39:28,049

there's only one chance and 200 that

940

00:39:33,319 --> 00:39:31,799

that planet would appear to transit okay

941

00:39:35,870 --> 00:39:33,329

all right we have a couple more

942

00:39:38,210 --> 00:39:35,880

questions on on the phone the next

943

00:39:39,849 --> 00:39:38,220

question is coming from Tracy Watson USA

944

00:39:43,099 --> 00:39:39,859

Today your line is open

945

00:39:45,140 --> 00:39:43,109

thank you I wanted to ask about ky7

946

00:39:47,630 --> 00:39:45,150

seven-11 if I've got that number right

947

00:39:48,620 --> 00:39:47,640

because you said it said right next it

948

00:39:49,910 --> 00:39:48,630

was used about the same amount of

949

00:39:52,910 --> 00:39:49,920

insulation it serves and at one point

950

00:39:55,249 --> 00:39:52,920

303 died can you put that into context

951
00:39:57,609 --> 00:39:55,259
for me how does that rank it then in

952
00:39:59,900 --> 00:39:57,619
terms of Earth twins this is now the

953
00:40:03,200 --> 00:39:59,910
closest I can't remember the statistics

954
00:40:06,200 --> 00:40:03,210
and the second question is about the

955
00:40:09,289 --> 00:40:06,210
kind of two flavors of planets is there

956
00:40:12,589 --> 00:40:09,299
any reason to think that that these two

957
00:40:14,299 --> 00:40:12,599
flavors are different in other parts of

958
00:40:17,469 --> 00:40:14,309
the universe or will this will apply

959
00:40:22,999 --> 00:40:17,479
elsewhere Thanks

960
00:40:25,489 --> 00:40:23,009
so 77 11 is the closest to the earth in

961
00:40:28,039 --> 00:40:25,499
terms of our current measurements of its

962
00:40:29,450 --> 00:40:28,049
size and how far away it is from our

963
00:40:31,160 --> 00:40:29,460

star and so as a result it gets

964

00:40:33,349 --> 00:40:31,170

approximately the same amount of heat

965

00:40:35,239 --> 00:40:33,359

that we get from our own star however

966

00:40:38,450 --> 00:40:35,249

there's a lot we don't know about this

967

00:40:40,219 --> 00:40:38,460

planet and as a result it's hard to say

968

00:40:42,229 --> 00:40:40,229

whether it's really an earth twin we

969

00:40:44,059 --> 00:40:42,239

need to know more about its atmosphere

970

00:40:46,099 --> 00:40:44,069

whether there's water on the planet I

971

00:40:47,900 --> 00:40:46,109

always like to remind people that it

972

00:40:48,650 --> 00:40:47,910

looks like there's three planets in our

973

00:40:50,900 --> 00:40:48,660

howls

974

00:40:54,860 --> 00:40:50,910

Venus Earth and Mars and I'd only really

975

00:40:56,900 --> 00:40:54,870

want to live on one of them and just to

976
00:40:58,760 --> 00:40:56,910
clarify Kepler can identify what

977
00:41:01,550 --> 00:40:58,770
properties of the of a planet we

978
00:41:03,980 --> 00:41:01,560
directly measure the size of the planet

979
00:41:05,990 --> 00:41:03,990
and how far away it is from the star so

980
00:41:08,360 --> 00:41:06,000
we don't know if it's habitable so we do

981
00:41:09,560 --> 00:41:08,370
not know if it's habitable all right we

982
00:41:12,500 --> 00:41:09,570
have a couple more questions on the line

983
00:41:15,950 --> 00:41:12,510
let's go there the next question is

984
00:41:17,000 --> 00:41:15,960
coming from it now greenfield voice NPR

985
00:41:19,130 --> 00:41:17,010
your line is open

986
00:41:21,950 --> 00:41:19,140
oh hey thanks for doing this just to

987
00:41:23,810 --> 00:41:21,960
confirm so I'll take the roughly 50

988
00:41:25,820 --> 00:41:23,820

number but I just want to make sure that

989

00:41:28,670 --> 00:41:25,830

the ten you're announcing today are in

990

00:41:30,920 --> 00:41:28,680

that number so it's not roughly 50 we

991

00:41:32,930 --> 00:41:30,930

knew about in terms of candidates in the

992

00:41:36,650 --> 00:41:32,940

habitable zone and the small potentially

993

00:41:39,320 --> 00:41:36,660

rocky size it's more like you know now

994

00:41:42,500 --> 00:41:39,330

in total we have 50 which includes these

995

00:41:43,850 --> 00:41:42,510

ten that you are announcing today and

996

00:41:47,030 --> 00:41:43,860

the other question I had is so if this

997

00:41:48,920 --> 00:41:47,040

is the final batch of data from Kepler's

998

00:41:51,410 --> 00:41:48,930

original mission I mean how are you guys

999

00:41:52,850 --> 00:41:51,420

feeling now do you feel sad like I guess

1000

00:41:55,550 --> 00:41:52,860

we've all gotten kind of used to these

1001
00:41:57,650 --> 00:41:55,560
big you know downloads of you know dumps

1002
00:41:59,420 --> 00:41:57,660
of potential planets where you know 200

1003
00:42:01,970 --> 00:41:59,430
potential planets just isn't really a

1004
00:42:04,220 --> 00:42:01,980
big deal anymore I mean is this like

1005
00:42:06,560 --> 00:42:04,230
kind of the end of an era for planetary

1006
00:42:08,090 --> 00:42:06,570
hunters or what do you think about that

1007
00:42:10,880 --> 00:42:08,100
since this is going to be the last one

1008
00:42:14,600 --> 00:42:10,890
from the original mission thing so

1009
00:42:16,790 --> 00:42:14,610
that's your first question the 10r part

1010
00:42:19,400 --> 00:42:16,800
our subset of that 50 that we're talking

1011
00:42:23,180 --> 00:42:19,410
about so we found 10 new ones and that

1012
00:42:25,070 --> 00:42:23,190
makes up the 50 as part of that 50 yeah

1013
00:42:26,900 --> 00:42:25,080

feels a bit like the end of an era but

1014

00:42:29,480 --> 00:42:26,910

actually I see it as a new beginning

1015

00:42:31,730 --> 00:42:29,490

it's amazing the things that Kepler has

1016

00:42:33,470 --> 00:42:31,740

found and we it has shown us these

1017

00:42:35,690 --> 00:42:33,480

terrestrial worlds and we still have all

1018

00:42:38,330 --> 00:42:35,700

this work to do to really understand how

1019

00:42:40,220 --> 00:42:38,340

common earths are in the galaxy so I'm

1020

00:42:42,440 --> 00:42:40,230

really excited to see what people are

1021

00:42:43,670 --> 00:42:42,450

going to do with this catalog because

1022

00:42:45,230 --> 00:42:43,680

this is the first time we have a

1023

00:42:46,970 --> 00:42:45,240

population that is really well

1024

00:42:48,800 --> 00:42:46,980

characterized and we can now do these

1025

00:42:54,620 --> 00:42:48,810

statistical studies and really start to

1026
00:43:00,570 --> 00:42:57,930
thank you the next question is coming

1027
00:43:01,670 --> 00:43:00,580
from a Lisa Grossman science news your

1028
00:43:04,200 --> 00:43:01,680
line is open

1029
00:43:06,240 --> 00:43:04,210
hi thanks for ticketing another question

1030
00:43:09,020 --> 00:43:06,250
from me so I just wanted to follow up a

1031
00:43:11,130 --> 00:43:09,030
little bit on Steph's first question so

1032
00:43:12,630 --> 00:43:11,140
Kepler's chief mission was to get a

1033
00:43:14,910 --> 00:43:12,640
number for this fraction of sun-like

1034
00:43:16,560 --> 00:43:14,920
stars at first light planet and you're

1035
00:43:19,080 --> 00:43:16,570
not releasing a number like that today

1036
00:43:20,940 --> 00:43:19,090
but you are releasing the final catalog

1037
00:43:24,290 --> 00:43:20,950
here's all the planets were ever going

1038
00:43:27,210 --> 00:43:24,300

to expect from Kepler is that enough to

1039

00:43:29,040 --> 00:43:27,220

to get that data earth number is that

1040

00:43:32,940 --> 00:43:29,050

going to get us there or is there more

1041

00:43:37,770 --> 00:43:32,950

that we need to do and why are you not

1042

00:43:39,240 --> 00:43:37,780

presenting any number for the fraction

1043

00:43:42,270 --> 00:43:39,250

of sun-like stars that the host

1044

00:43:44,070 --> 00:43:42,280

earth-like planet today that's a great

1045

00:43:47,250 --> 00:43:44,080

question to address the importance of

1046

00:43:50,250 --> 00:43:47,260

this catalog I've already forgot the

1047

00:43:52,620 --> 00:43:50,260

beginning question oh yes oh yes we

1048

00:43:55,140 --> 00:43:52,630

absolutely have enough to do those

1049

00:43:57,330 --> 00:43:55,150

studies we have a population of high

1050

00:43:59,940 --> 00:43:57,340

confidence planets that are terrestrial

1051
00:44:02,850 --> 00:43:59,950
sized and in the habitable zone of

1052
00:44:04,590 --> 00:44:02,860
sun-like stars the reason we haven't

1053
00:44:07,320 --> 00:44:04,600
done this is this analysis is very

1054
00:44:09,600 --> 00:44:07,330
complicated and there's a lot of pieces

1055
00:44:12,480 --> 00:44:09,610
that go into it but at least we now have

1056
00:44:14,250 --> 00:44:12,490
all of those pieces and scientists will

1057
00:44:16,710 --> 00:44:14,260
spend the next year talking about how to

1058
00:44:22,020 --> 00:44:16,720
get to the most accurate number and the

1059
00:44:23,430 --> 00:44:22,030
best way to go about it right let's go

1060
00:44:29,540 --> 00:44:23,440
to a question here we have them in the

1061
00:44:33,330 --> 00:44:29,550
live audience did you find anything

1062
00:44:36,450 --> 00:44:33,340
anomalous when you were looking through

1063
00:44:38,880 --> 00:44:36,460

through all of these all this data there

1064

00:44:41,970 --> 00:44:38,890

was some talk I don't know several

1065

00:44:45,300 --> 00:44:41,980

months to a year ago about a potential

1066

00:44:46,770 --> 00:44:45,310

giant artifact in space did you did you

1067

00:44:51,089 --> 00:44:46,780

see anything that you can't quite

1068

00:44:55,349 --> 00:44:52,979

could you clarify a little bit which

1069

00:44:58,229 --> 00:44:55,359

would well I there was a well-known news

1070

00:44:58,559 --> 00:44:58,239

story that came out I think about a year

1071

00:45:05,870 --> 00:44:58,569

ago

1072

00:45:10,079 --> 00:45:05,880

and the the what the big sail the

1073

00:45:12,839 --> 00:45:10,089

sailing alien uh superstructure yeah

1074

00:45:15,870 --> 00:45:12,849

that's it thank you yeah

1075

00:45:19,229 --> 00:45:15,880

so without specific regard to that or

1076
00:45:21,420 --> 00:45:19,239
were there anything well did you find

1077
00:45:24,989 --> 00:45:21,430
anything out there in the vastness of

1078
00:45:27,839 --> 00:45:24,999
space that you can't account for

1079
00:45:33,299 --> 00:45:27,849
according to what we know in science

1080
00:45:34,950 --> 00:45:33,309
today the the light curves from Kepler

1081
00:45:37,079 --> 00:45:34,960
are truly unique the way we did the

1082
00:45:39,809 --> 00:45:37,089
search means that we really just find

1083
00:45:42,120 --> 00:45:39,819
things that are similar to planets and

1084
00:45:43,739 --> 00:45:42,130
so this catalog itself I didn't find

1085
00:45:45,839 --> 00:45:43,749
anything where I just absolutely could

1086
00:45:49,349 --> 00:45:45,849
not explain what I was looking at but

1087
00:45:51,509 --> 00:45:49,359
that said other people have mined the

1088
00:45:53,279 --> 00:45:51,519

Kepler light curves looking for other

1089

00:45:56,749 --> 00:45:53,289

interesting things and that's how they

1090

00:46:00,299 --> 00:45:56,759

found that that star with the large

1091

00:46:02,190 --> 00:46:00,309

changes in brightness that happened and

1092

00:46:04,680 --> 00:46:02,200

they're continuing to observe that to

1093

00:46:06,569 --> 00:46:04,690

figure out what kind of star that is I

1094

00:46:08,160 --> 00:46:06,579

think I just saw on Twitter that it's

1095

00:46:14,489 --> 00:46:08,170

decreased in brightness again by about

1096

00:46:17,000 --> 00:46:14,499

two percent as far as I know no thank

1097

00:46:21,660 --> 00:46:19,260

great well we have a number of questions

1098

00:46:23,790 --> 00:46:21,670

also come in through social media and on

1099

00:46:25,590 --> 00:46:23,800

Twitter so we'll go there take a couple

1100

00:46:29,280 --> 00:46:25,600

questions the first ones come first one

1101
00:46:31,080 --> 00:46:29,290
comes from Doug for far worlds are there

1102
00:46:32,670 --> 00:46:31,090
any Kepler candidates to be announced

1103
00:46:35,280 --> 00:46:32,680
today or otherwise that are circumbinary

1104
00:46:38,210 --> 00:46:35,290
terrestrial planets now maybe we could

1105
00:46:41,970 --> 00:46:38,220
answer what a circumbinary planet is

1106
00:46:45,540 --> 00:46:41,980
start off Kepler did find a about a

1107
00:46:48,120 --> 00:46:45,550
dozen I believe planets that go around a

1108
00:46:49,380 --> 00:46:48,130
binary system so there's two stars going

1109
00:46:52,620 --> 00:46:49,390
around each other and then there's

1110
00:46:55,080 --> 00:46:52,630
planets going around those those binary

1111
00:46:56,910 --> 00:46:55,090
system because of the way this catalog

1112
00:47:02,970 --> 00:46:56,920
was created we are not set up to find

1113
00:47:04,320 --> 00:47:02,980

those very interesting systems you said

1114

00:47:07,220 --> 00:47:04,330

there's about 12 that we found so I

1115

00:47:09,270 --> 00:47:07,230

believe that's the number today alright

1116

00:47:13,220 --> 00:47:09,280

let's take another question here from

1117

00:47:16,680 --> 00:47:13,230

social media this comes from at TSA

1118

00:47:20,100 --> 00:47:16,690

mulato how long do you estimate Kepler

1119

00:47:23,370 --> 00:47:20,110

to remain upright or in orbit and would

1120

00:47:25,680 --> 00:47:23,380

it live would it live till test launches

1121

00:47:28,440 --> 00:47:25,690

and its science mission starts maybe

1122

00:47:30,180 --> 00:47:28,450

that's why I'm tamari oh yeah yes now as

1123

00:47:32,250 --> 00:47:30,190

we mention here

1124

00:47:34,560 --> 00:47:32,260

Kepler is still taking data and we're on

1125

00:47:37,230 --> 00:47:34,570

the k2 mission which is a secondary

1126
00:47:40,110 --> 00:47:37,240
mission which we have been doing for the

1127
00:47:42,930 --> 00:47:40,120
last four years this mission can only

1128
00:47:46,970 --> 00:47:42,940
observe for about 80 days determine feel

1129
00:47:51,470 --> 00:47:46,980
around the ecliptic plane of the galaxy

1130
00:47:55,800 --> 00:47:51,480
we expect to have for sure fuel until

1131
00:47:58,170 --> 00:47:55,810
our campaigns our campaign number 16 we

1132
00:48:00,810 --> 00:47:58,180
are in campaign number 14 right now so

1133
00:48:04,170 --> 00:48:00,820
and about the end of this year starting

1134
00:48:06,150 --> 00:48:04,180
next year we'll start campaign 17 which

1135
00:48:08,640 --> 00:48:06,160
we don't know if the fuel the fuel is

1136
00:48:11,700 --> 00:48:08,650
the main limitation that we have will

1137
00:48:14,040 --> 00:48:11,710
with Kepler it's very hard to measure

1138
00:48:16,350 --> 00:48:14,050

the fuel in space and for that reason it

1139

00:48:20,450 --> 00:48:16,360

being done indirectly but respect to

1140

00:48:25,320 --> 00:48:20,460

still be observing during the year 19

1141

00:48:29,160 --> 00:48:25,330

impossibly even beyond that now test is

1142

00:48:30,450 --> 00:48:29,170

going to start flying next year in 2018

1143

00:48:34,640 --> 00:48:30,460

if possible they overlap

1144

00:48:37,200 --> 00:48:34,650

however I think the overlap is only

1145

00:48:40,770 --> 00:48:37,210

nominal there's not really significance

1146

00:48:42,960 --> 00:48:40,780

the since Kepler still will keep

1147

00:48:46,349 --> 00:48:42,970

observing a small piece of the sky

1148

00:48:49,589 --> 00:48:46,359

around the Galactic plane and Kepler

1149

00:48:52,380 --> 00:48:49,599

will press or in test will do all Sky

1150

00:48:54,930 --> 00:48:52,390

Survey both of the northern sky and the

1151
00:48:57,570 --> 00:48:54,940
southern skies in the first two year of

1152
00:49:00,630 --> 00:48:57,580
test will be done one year doing the

1153
00:49:03,540 --> 00:49:00,640
southern sky and the next year be doing

1154
00:49:05,880 --> 00:49:03,550
the northern sky and later will be

1155
00:49:08,010 --> 00:49:05,890
pointed observations so test will be

1156
00:49:10,560 --> 00:49:08,020
doing a completely different mission and

1157
00:49:13,530 --> 00:49:10,570
will the target target population of

1158
00:49:15,780 --> 00:49:13,540
tasks will be mostly nearby and very

1159
00:49:18,990 --> 00:49:15,790
bright star which different from what

1160
00:49:22,290 --> 00:49:19,000
Kepler has been doing even during the k2

1161
00:49:24,960 --> 00:49:22,300
mission alright thank you here's another

1162
00:49:28,770 --> 00:49:24,970
question from social media from at

1163
00:49:30,980 --> 00:49:28,780

playtime with tests just to confirm we

1164

00:49:33,930 --> 00:49:30,990

can only see planets whose solar systems

1165

00:49:36,120 --> 00:49:33,940

elliptical plane is aligned towards our

1166

00:49:38,460 --> 00:49:36,130

planet now what do you want to take that

1167

00:49:41,070 --> 00:49:38,470

just distinguish between the transiting

1168

00:49:42,720 --> 00:49:41,080

worlds in that's for this particular

1169

00:49:44,400 --> 00:49:42,730

method of detection where the planet

1170

00:49:45,990 --> 00:49:44,410

passes between us and the star but there

1171

00:49:47,670 --> 00:49:46,000

are other detection methods for instance

1172

00:49:48,780 --> 00:49:47,680

the radio velocity method that are

1173

00:49:50,760 --> 00:49:48,790

sensitive to planets that are in

1174

00:49:52,200 --> 00:49:50,770

different orientations so we're able to

1175

00:49:54,030 --> 00:49:52,210

piece together results from different

1176
00:49:55,650 --> 00:49:54,040
types of Planet detection methods in

1177
00:49:59,250 --> 00:49:55,660
order to see planets that aren't just

1178
00:50:00,599 --> 00:49:59,260
perfectly aligned with us great I

1179
00:50:05,280 --> 00:50:00,609
believe we had one more question on the

1180
00:50:08,579 --> 00:50:05,290
line actually we have a question here in

1181
00:50:09,060 --> 00:50:08,589
the room AR I'm at Bigler ke CBS CBS

1182
00:50:11,910 --> 00:50:09,070
News

1183
00:50:13,920 --> 00:50:11,920
my son turns four this week he's getting

1184
00:50:16,020 --> 00:50:13,930
his first telescope it's actually a type

1185
00:50:19,020 --> 00:50:16,030
of spotting scope but it'll count as a

1186
00:50:21,599 --> 00:50:19,030
telescope could you explain to him what

1187
00:50:23,190 --> 00:50:21,609
your announcement is today why it's

1188
00:50:25,050 --> 00:50:23,200

important and I think if you do that

1189

00:50:28,260 --> 00:50:25,060

that will help me explain to your

1190

00:50:32,180 --> 00:50:28,270

average news consumer what it is that

1191

00:50:37,609 --> 00:50:34,250

uh you think this would be easy because

1192

00:50:39,950 --> 00:50:37,619

I have a five-year-old at home so what I

1193

00:50:46,280 --> 00:50:39,960

do is I work at the airport is what he

1194

00:50:49,430 --> 00:50:46,290

thinks I do so what's exciting about

1195

00:50:52,910 --> 00:50:49,440

today is we have taken our telescope and

1196

00:50:56,120 --> 00:50:52,920

we have counted up how many planets are

1197

00:50:56,660 --> 00:50:56,130

similar to the earth in this part of the

1198

00:51:01,460 --> 00:50:56,670

sky

1199

00:51:05,180 --> 00:51:01,470

and we said how many planets are there

1200

00:51:08,210 --> 00:51:05,190

that are similar to the earth and with

1201
00:51:12,800 --> 00:51:08,220
the data I have I can now make that

1202
00:51:15,260 --> 00:51:12,810
count and from there we're going to

1203
00:51:18,770 --> 00:51:15,270
determine how common other planets are

1204
00:51:21,680 --> 00:51:18,780
can we find it are there places that we

1205
00:51:26,990 --> 00:51:21,690
could live in the galaxy besides this

1206
00:51:31,160 --> 00:51:27,000
place that we call home that close and

1207
00:51:32,540 --> 00:51:31,170
yeah I resolved I think it's maybe a

1208
00:51:35,270 --> 00:51:32,550
little easier to describe it as far as

1209
00:51:36,680 --> 00:51:35,280
planets it's just like animals it's just

1210
00:51:39,980 --> 00:51:36,690
like when biologists discover a new

1211
00:51:42,380 --> 00:51:39,990
species of animals in this case we what

1212
00:51:44,420 --> 00:51:42,390
we thought was a single species of

1213
00:51:47,809 --> 00:51:44,430

animals is in fact two very different

1214

00:51:49,550 --> 00:51:47,819

things so that's I think that that boils

1215

00:51:50,720 --> 00:51:49,560

it down pretty nicely all right thank

1216

00:51:54,440 --> 00:51:50,730

you let's take another question from

1217

00:51:56,180 --> 00:51:54,450

online this comes from von Bismark how

1218

00:51:59,000 --> 00:51:56,190

big what an orbiting telescope like

1219

00:52:01,280 --> 00:51:59,010

Hubble need to be to get photos of these

1220

00:52:02,630 --> 00:52:01,290

distant planets and we could expand a

1221

00:52:04,640 --> 00:52:02,640

little bit and we're talking about the

1222

00:52:06,920 --> 00:52:04,650

future now and and those steps to get to

1223

00:52:08,359 --> 00:52:06,930

that point I think it's important to

1224

00:52:10,220 --> 00:52:08,369

keep in mind that when we talk about

1225

00:52:11,870 --> 00:52:10,230

directly imaging planets and the

1226
00:52:13,430 --> 00:52:11,880
habitable zones of nearby stars we're

1227
00:52:14,690 --> 00:52:13,440
not talking about making a beautiful

1228
00:52:16,309 --> 00:52:14,700
picture like the one you might hang on

1229
00:52:18,260 --> 00:52:16,319
your office wall we're talking about

1230
00:52:20,690 --> 00:52:18,270
collecting enough photons from the

1231
00:52:22,940 --> 00:52:20,700
planet to fill a pixel in your image and

1232
00:52:24,140 --> 00:52:22,950
then you study that image over time and

1233
00:52:26,030 --> 00:52:24,150
try to make guesses as to what the

1234
00:52:28,250 --> 00:52:26,040
surface could look like based on the

1235
00:52:29,990 --> 00:52:28,260
features you see in the planet for the

1236
00:52:31,640 --> 00:52:30,000
telescope designs we're considering for

1237
00:52:34,099 --> 00:52:31,650
the 2030s we're thinking about things

1238
00:52:36,109 --> 00:52:34,109

that might be the size of say 45 feet

1239

00:52:37,430 --> 00:52:36,119

across and that wouldn't give us a

1240

00:52:39,109 --> 00:52:37,440

picture of the planet but it would give

1241

00:52:40,069 --> 00:52:39,119

us the information we need to assess

1242

00:52:42,500 --> 00:52:40,079

whether that planet

1243

00:52:44,100 --> 00:52:42,510

might be some place that's hospitable to

1244

00:52:45,270 --> 00:52:44,110

life

1245

00:52:50,120 --> 00:52:45,280

all right thank you let's take another

1246

00:52:53,550 --> 00:52:50,130

one from social media this comes from PC

1247

00:52:55,650 --> 00:52:53,560

415 have any of these planet candidates

1248

00:53:02,670 --> 00:52:55,660

given any hint as to having large moons

1249

00:53:05,580 --> 00:53:02,680

or ring systems I did not find any

1250

00:53:08,970 --> 00:53:05,590

evidence of moons or rings around our

1251
00:53:10,710 --> 00:53:08,980
planets in this particular catalogue and

1252
00:53:12,780 --> 00:53:10,720
those are even more difficult to discern

1253
00:53:17,360 --> 00:53:12,790
extremely difficult out there looking

1254
00:53:22,320 --> 00:53:20,040
what here's another one from social

1255
00:53:24,680 --> 00:53:22,330
media ad t tcats

1256
00:53:30,630 --> 00:53:24,690
Wow which is the nearest planet

1257
00:53:33,140 --> 00:53:30,640
exoplanet and how far from us is it to

1258
00:53:35,930 --> 00:53:33,150
Rea be the plan around the closest star

1259
00:53:38,760 --> 00:53:35,940
and that's about four light-years yeah

1260
00:53:40,100 --> 00:53:38,770
great alright alright I think we have

1261
00:53:42,360 --> 00:53:40,110
one more question on the line

1262
00:53:44,490 --> 00:53:42,370
the next question is coming from Seth

1263
00:53:45,230 --> 00:53:44,500

Borenstein The Associated Press your

1264

00:53:47,750 --> 00:53:45,240

line is open

1265

00:53:52,740 --> 00:53:47,760

thank you again sorry to keep bothering

1266

00:53:54,240 --> 00:53:52,750

asking these questions can ask most of

1267

00:53:56,520 --> 00:53:54,250

the panels for all the panel's just to

1268

00:53:59,490 --> 00:53:56,530

go back eight years nine years before

1269

00:54:03,390 --> 00:53:59,500

Kepler was launched had you've been told

1270

00:54:05,880 --> 00:54:03,400

you would find 50 earth-like I mean have

1271

00:54:09,540 --> 00:54:05,890

you rocky planets in the habitable zone

1272

00:54:11,190 --> 00:54:09,550

is that a number um you know if you put

1273

00:54:14,520 --> 00:54:11,200

yourself would you be disappointed with

1274

00:54:17,070 --> 00:54:14,530

50 would you be more than surprised to

1275

00:54:19,530 --> 00:54:17,080

this beyond what you expected just to

1276

00:54:21,300 --> 00:54:19,540

put you know in other words is this more

1277

00:54:23,520 --> 00:54:21,310

than you expected is this less is this

1278

00:54:28,100 --> 00:54:23,530

about what you expected a sense you know

1279

00:54:30,450 --> 00:54:28,110

if you go back pre pre data thank you

1280

00:54:33,180 --> 00:54:30,460

this number could have been very very

1281

00:54:35,100 --> 00:54:33,190

small and I for one am ecstatic that

1282

00:54:36,840 --> 00:54:35,110

we've found 50 potentially habitable

1283

00:54:39,910 --> 00:54:36,850

worlds orbiting nearby stars that's

1284

00:54:44,529 --> 00:54:42,430

yeah eight years ago I was just starting

1285

00:54:46,450 --> 00:54:44,539

out and professional astronomy and we

1286

00:54:47,859 --> 00:54:46,460

definitely knew very little compared to

1287

00:54:50,230 --> 00:54:47,869

what we know now about the population of

1288

00:54:52,720 --> 00:54:50,240

exoplanets we really had no idea how

1289

00:54:55,480 --> 00:54:52,730

common earth planets earth-like planets

1290

00:54:56,680 --> 00:54:55,490

were and so that's that's why we made

1291

00:54:58,240 --> 00:54:56,690

the kepler mission was to answer that

1292

00:55:00,579 --> 00:54:58,250

question and we're still working on that

1293

00:55:01,660 --> 00:55:00,589

answer it's very difficult there are you

1294

00:55:04,329 --> 00:55:01,670

know many groups that have come up with

1295

00:55:06,730 --> 00:55:04,339

numbers and we're starting to converge

1296

00:55:08,109 --> 00:55:06,740

on the final answer but I am definitely

1297

00:55:10,890 --> 00:55:08,119

ecstatic that we've discovered that

1298

00:55:15,450 --> 00:55:10,900

amount I think that that is definitely a

1299

00:55:18,519 --> 00:55:15,460

nice number that I would have hoped for

1300

00:55:20,589 --> 00:55:18,529

number 50 is from what Kepler was able

1301
00:55:23,170 --> 00:55:20,599
to observe now the actual number the

1302
00:55:27,220 --> 00:55:23,180
intrinsic number in the galaxy is we're

1303
00:55:29,650 --> 00:55:27,230
talking in the billions yeah okay I

1304
00:55:32,319 --> 00:55:29,660
think we have one last question on the

1305
00:55:35,230 --> 00:55:32,329
phone go ahead a next question is going

1306
00:55:36,960 --> 00:55:35,240
to be from jonathan callahan IFL science

1307
00:55:40,029 --> 00:55:36,970
your line is open

1308
00:55:42,400 --> 00:55:40,039
hello thank you for taking my call I

1309
00:55:46,059 --> 00:55:42,410
have a question regarding finding an log

1310
00:55:48,430 --> 00:55:46,069
as I understand it this is Captain end

1311
00:55:50,499 --> 00:55:48,440
of its four year mission and to find

1312
00:55:52,960 --> 00:55:50,509
Condor scimitars we need to see three

1313
00:55:55,150 --> 00:55:52,970

transit so three years three years of

1314

00:55:57,549 --> 00:55:55,160

observations are there any more missions

1315

00:56:00,370 --> 00:55:57,559

planned in the future to find similar

1316

00:56:00,930 --> 00:56:00,380

planets from similar lengthy orbit thank

1317

00:56:03,819 --> 00:56:00,940

you

1318

00:56:05,230 --> 00:56:03,829

the plateau mission out of Europe will

1319

00:56:07,029 --> 00:56:05,240

have the potential to find planets very

1320

00:56:09,099 --> 00:56:07,039

long period orbits because that mission

1321

00:56:10,720 --> 00:56:09,109

will be staring for roughly two years in

1322

00:56:12,579 --> 00:56:10,730

certain patch of the sky as well as

1323

00:56:14,470 --> 00:56:12,589

doing another set of steps where they

1324

00:56:16,779 --> 00:56:14,480

look at fields for Less durations of

1325

00:56:18,339 --> 00:56:16,789

time with the test mission depending on

1326

00:56:20,019 --> 00:56:18,349

what they choose to do in year three and

1327

00:56:22,029 --> 00:56:20,029

beyond perhaps they could also find

1328

00:56:23,349 --> 00:56:22,039

planets very long period orbits but one

1329

00:56:25,269 --> 00:56:23,359

of the pathways we're considering going

1330

00:56:27,519 --> 00:56:25,279

forward is finding a planet with a

1331

00:56:29,769 --> 00:56:27,529

transiting survey whether it's Kepler k2

1332

00:56:31,809 --> 00:56:29,779

or tests following up with other

1333

00:56:33,009 --> 00:56:31,819

missions perhaps using radio velocity

1334

00:56:34,539 --> 00:56:33,019

from the ground to measure the mass the

1335

00:56:36,370 --> 00:56:34,549

planet and then doing targeted

1336

00:56:38,140 --> 00:56:36,380

observations of that particular star to

1337

00:56:39,700 --> 00:56:38,150

confirm it so we don't necessarily need

1338

00:56:41,289 --> 00:56:39,710

to use the same spacecraft to see all

1339

00:56:44,349 --> 00:56:41,299

three transits Mario do you have

1340

00:56:46,720 --> 00:56:44,359

something you would add yes let me

1341

00:56:49,599 --> 00:56:46,730

remind people that the first exoplanet

1342

00:56:52,150 --> 00:56:49,609

were found only about 22 years ago so

1343

00:56:53,440 --> 00:56:52,160

there's a very young field and NASA is

1344

00:56:55,930 --> 00:56:53,450

very interested in continuing

1345

00:56:58,569 --> 00:56:55,940

path the announcement we made today

1346

00:57:01,210 --> 00:56:58,579

really at the beginning of this path and

1347

00:57:04,180 --> 00:57:01,220

to continue searching for new worlds and

1348

00:57:07,260 --> 00:57:04,190

finding signs of life and beyond our

1349

00:57:10,210 --> 00:57:07,270

solar system nASA has a path to continue

1350

00:57:13,359 --> 00:57:10,220

studying right now we're studying for a

1351
00:57:16,060 --> 00:57:13,369
large mission concept which which two of

1352
00:57:18,940 --> 00:57:16,070
they are capable to do great work and

1353
00:57:24,130 --> 00:57:18,950
advance the field of exoplanet however

1354
00:57:25,180 --> 00:57:24,140
we we don't ourselves determine the type

1355
00:57:28,060 --> 00:57:25,190
of mission we're going to do in the

1356
00:57:29,560 --> 00:57:28,070
future this is a it's a task given by

1357
00:57:31,870 --> 00:57:29,570
Congress to the National Academy of

1358
00:57:35,500 --> 00:57:31,880
Sciences which every 10 years advise us

1359
00:57:41,170 --> 00:57:35,510
to continue with this plan so in 2020 we

1360
00:57:43,359 --> 00:57:41,180
will be here and we have high pectin see

1361
00:57:45,460 --> 00:57:43,369
that several of these activities

1362
00:57:47,950 --> 00:57:45,470
including probe mission which are

1363
00:57:50,829 --> 00:57:47,960

mid-size class like Kepler a large

1364

00:57:53,710 --> 00:57:50,839

mission will be recommended to the

1365

00:57:55,839 --> 00:57:53,720

agency to NASA to continue this search

1366

00:57:58,990 --> 00:57:55,849

so we are really at the beginning of the

1367

00:58:02,650 --> 00:57:59,000

path although Kepler was launched about

1368

00:58:06,700 --> 00:58:02,660

eight years ago this felis only 22 years

1369

00:58:08,980 --> 00:58:06,710

old really will be continuing this

1370

00:58:13,300 --> 00:58:08,990

search for life in fact within the

1371

00:58:17,230 --> 00:58:13,310

agency the earth 2.0 is an iconic goal

1372

00:58:20,710 --> 00:58:17,240

that respect to to reach maybe in the

1373

00:58:21,010 --> 00:58:20,720

next 5 10 or 20 years but let me say one

1374

00:58:27,180 --> 00:58:21,020

thing

1375

00:58:29,050 --> 00:58:27,190

alone and maybe Kepler today had tell us

1376

00:58:30,790 --> 00:58:29,060

indirectly although with our

1377

00:58:35,380 --> 00:58:30,800

confirmation that we are probably not a

1378

00:58:37,180 --> 00:58:35,390

lot right let's take one more question

1379

00:58:39,309 --> 00:58:37,190

and then we're going to wrap up for the

1380

00:58:42,609 --> 00:58:39,319

day the questions coming from from

1381

00:58:45,819 --> 00:58:42,619

social media it's regarding James Webb

1382

00:58:48,190 --> 00:58:45,829

Space Telescope and that next step so

1383

00:58:50,800 --> 00:58:48,200

JWST is scheduled to launch next next

1384

00:58:54,849 --> 00:58:50,810

year how many of these planets will be

1385

00:58:58,480 --> 00:58:54,859

priorities for atmosphere study let me

1386

00:59:01,700 --> 00:58:58,490

explain that just a little bit briefly

1387

00:59:03,740 --> 00:59:01,710

mario's that's a detail all I would say

1388

00:59:06,020 --> 00:59:03,750

all of them although a few of them are

1389

00:59:10,010 --> 00:59:06,030

already in the queue to be observed in

1390

00:59:12,080 --> 00:59:10,020

fact many of the Kepler most interesting

1391

00:59:14,330 --> 00:59:12,090

targets already part of the early

1392

00:59:16,130 --> 00:59:14,340

science release in which four of the

1393

00:59:18,830 --> 00:59:16,140

instruments of James Webb will be

1394

00:59:20,900 --> 00:59:18,840

pointed starting during even the

1395

00:59:24,170 --> 00:59:20,910

commissioning time after the launch in

1396

00:59:26,960 --> 00:59:24,180

November 2018 next year so I would say

1397

00:59:28,820 --> 00:59:26,970

all all of them us at the community

1398

00:59:31,790 --> 00:59:28,830

advanced in the new observing cycle

1399

00:59:34,670 --> 00:59:31,800

James Webb will be able to inject this

1400

00:59:37,190 --> 00:59:34,680

the target to be follow up by James Webb

1401

00:59:38,600 --> 00:59:37,200

and the many other spacecraft was

1402

00:59:43,130 --> 00:59:38,610

servicing for example remind you that

1403

00:59:45,530 --> 00:59:43,140

Hubble still is in still observing us in

1404

00:59:49,040 --> 00:59:45,540

the 27-year observing and will continue

1405

00:59:51,350 --> 00:59:49,050

for many more years to go so Hubble in

1406

00:59:53,780 --> 00:59:51,360

the spitzer hopefully will be observing

1407

00:59:57,380 --> 00:59:53,790

for a few more year will be very helpful

1408

00:59:59,930 --> 00:59:57,390

in this path of characterizing this very

1409

01:00:00,380 --> 00:59:59,940

interesting new world alright thank you

1410

01:00:02,990 --> 01:00:00,390

Mario

1411

01:00:05,330 --> 01:00:03,000

very exciting steps on the horizon on

1412

01:00:08,210 --> 01:00:05,340

our way to confirm whether or not we are

1413

01:00:10,040 --> 01:00:08,220

alone well we'll wrap it for today's

1414

01:00:12,050 --> 01:00:10,050

briefing I'd like to thank the panelists

1415

01:00:13,730 --> 01:00:12,060

for sharing these exciting results I'd

1416

01:00:15,320 --> 01:00:13,740

like to thank everyone here in the live

1417

01:00:18,260 --> 01:00:15,330

audience and for those of you joining on

1418

01:00:19,850 --> 01:00:18,270

the call as well as online if you joined

1419

01:00:20,990 --> 01:00:19,860

in late don't worry we have the

1420

01:00:22,640 --> 01:00:21,000

materials that you heard today and

1421

01:00:28,160 --> 01:00:22,650

recording of this press conference

1422

01:00:29,780 --> 01:00:28,170

online at [WWE gov 4 / Kepler](#) if you'd

1423

01:00:33,460 --> 01:00:29,790

like to follow us on social media you

1424

01:00:36,800 --> 01:00:33,470

can find us on Twitter at [wwe.com](#)

1425

01:00:38,080 --> 01:00:36,810

forward slash NASA Kepler and also on

1426

01:00:41,660 --> 01:00:38,090

Facebook

1427

01:00:45,650 --> 01:00:41,670

WWF ace book.com forward slash NASA's

1428

01:00:47,420 --> 01:00:45,660

Kepler mission so thanks for tuning in