
YOU TOO CAN DO
NASA SCIENCE
NASA
SCIENCE LIVE
VIRTUAL EDITION

1
00:00:00,950 --> 00:00:08,150
[Music]

2
00:00:11,749 --> 00:00:10,070
what if i told you that no matter who

3
00:00:13,990 --> 00:00:11,759
you are or where you are

4
00:00:15,669 --> 00:00:14,000
you can participate in science at nasa

5
00:00:17,910 --> 00:00:15,679
and make real world discoveries

6
00:00:20,470 --> 00:00:17,920
alongside nasa scientists

7
00:00:22,710 --> 00:00:20,480
hello i'm your host emily ferfaro and

8
00:00:24,150 --> 00:00:22,720
this is another virtual episode of nasa

9
00:00:26,310 --> 00:00:24,160
science live

10
00:00:28,550 --> 00:00:26,320
from mapping the ocean floors to

11
00:00:29,750 --> 00:00:28,560
discovering new planets outside of our

12
00:00:31,750 --> 00:00:29,760
solar system

13
00:00:32,790 --> 00:00:31,760

nasa has so many different citizen

14
00:00:35,030 --> 00:00:32,800
science projects

15
00:00:37,430 --> 00:00:35,040
where members of the public actually

16
00:00:39,830 --> 00:00:37,440
collaborate with nasa scientists to make

17
00:00:41,990 --> 00:00:39,840
amazing discoveries together

18
00:00:44,030 --> 00:00:42,000
nasa's chief scientist jim green is here

19
00:00:46,389 --> 00:00:44,040
to tell us more

20
00:00:49,590 --> 00:00:46,399
[Music]

21
00:00:50,470 --> 00:00:49,600
have you ever had an aha moment that

22
00:00:53,270 --> 00:00:50,480
feeling when

23
00:00:54,229 --> 00:00:53,280
everything just seems to make sense

24
00:00:58,549 --> 00:00:54,239
scientists

25
00:01:01,110 --> 00:00:58,559
have them all the time hi i'm jim green

26
00:01:01,830 --> 00:01:01,120
nasa's chief scientist and i have

27
00:01:04,229 --> 00:01:01,840
discovered

28
00:01:05,030 --> 00:01:04,239
many new things in my career and let me

29
00:01:07,270 --> 00:01:05,040
tell you

30
00:01:08,310 --> 00:01:07,280
there's nothing quite like that feeling

31
00:01:11,190 --> 00:01:08,320
when you discover

32
00:01:13,109 --> 00:01:11,200
something important that no one in the

33
00:01:15,510 --> 00:01:13,119
world knows

34
00:01:17,350 --> 00:01:15,520
what if i told you that through nasa's

35
00:01:20,950 --> 00:01:17,360
citizen science program

36
00:01:23,749 --> 00:01:20,960
you too can experience that same feeling

37
00:01:25,590 --> 00:01:23,759
are you interested citizen scientists

38
00:01:28,230 --> 00:01:25,600

working with nasa have made

39
00:01:28,870 --> 00:01:28,240
many significant discoveries some of

40
00:01:32,149 --> 00:01:28,880
them

41
00:01:36,069 --> 00:01:32,159
right from their own home for instance

42
00:01:37,350 --> 00:01:36,079
54 000 circumstellar disks have been

43
00:01:40,870 --> 00:01:37,360
found by citizen

44
00:01:45,270 --> 00:01:40,880
scientists what are they these are

45
00:01:48,469 --> 00:01:45,280
debris fields around stars in our galaxy

46
00:01:51,350 --> 00:01:48,479
where planets are being formed for the

47
00:01:53,510 --> 00:01:51,360
very first time

48
00:01:54,710 --> 00:01:53,520
what about the citizen scientists that

49
00:01:58,310 --> 00:01:54,720
have discovered

50
00:02:01,429 --> 00:01:58,320
18 000 mosquito breeding sites

51
00:02:02,709 --> 00:02:01,439
in nasa earth science images breeding

52
00:02:04,870 --> 00:02:02,719
sites like these

53
00:02:06,230 --> 00:02:04,880
are important to first find since

54
00:02:09,749 --> 00:02:06,240
mosquitoes

55
00:02:11,990 --> 00:02:09,759
carry all sorts of diseases so

56
00:02:14,470 --> 00:02:12,000
there are many other discoveries going

57
00:02:17,910 --> 00:02:14,480
on in nasa's citizen science

58
00:02:21,110 --> 00:02:17,920
projects and you can get involved

59
00:02:23,110 --> 00:02:21,120
these projects are real collaborations

60
00:02:26,630 --> 00:02:23,120
between scientists

61
00:02:28,949 --> 00:02:26,640
and a interested public like you

62
00:02:31,589 --> 00:02:28,959
i am sure some of you might be saying

63
00:02:34,150 --> 00:02:31,599

well i don't have a fancy degree

64
00:02:35,670 --> 00:02:34,160
or i can't discover new planets beyond

65
00:02:38,470 --> 00:02:35,680
our solar system

66
00:02:40,949 --> 00:02:38,480
and you'd be wrong you don't have to

67
00:02:43,589 --> 00:02:40,959
have a special degree or job title

68
00:02:45,270 --> 00:02:43,599
in fact you don't even need to have

69
00:02:47,589 --> 00:02:45,280
experience

70
00:02:48,470 --> 00:02:47,599
if you're curious about our universe and

71
00:02:51,030 --> 00:02:48,480
about

72
00:02:53,190 --> 00:02:51,040
our planet earth you can get involved

73
00:02:56,229 --> 00:02:53,200
with real nasa projects

74
00:02:57,509 --> 00:02:56,239
and work alongside real scientists right

75
00:02:59,990 --> 00:02:57,519
now

76
00:03:01,190 --> 00:03:00,000
so what are you waiting for come on and

77
00:03:05,350 --> 00:03:01,200
join us

78
00:03:12,949 --> 00:03:05,360
to get started go to science.nasa.gov

79
00:03:16,630 --> 00:03:14,790
i don't know about you but hearing about

80
00:03:17,350 --> 00:03:16,640
the discoveries made by citizen

81
00:03:20,229 --> 00:03:17,360
scientists

82
00:03:20,710 --> 00:03:20,239
is so exciting if you're anything like

83
00:03:22,790 --> 00:03:20,720
me

84
00:03:23,990 --> 00:03:22,800
i science was always interesting but i

85
00:03:26,309 --> 00:03:24,000
never thought i could be

86
00:03:27,670 --> 00:03:26,319
a scientist so it was great to hear dr

87
00:03:29,030 --> 00:03:27,680
green talk about how

88
00:03:31,270 --> 00:03:29,040

anyone can get involved with these

89
00:03:33,190 --> 00:03:31,280
projects and make discoveries

90
00:03:34,869 --> 00:03:33,200
there are so many great projects that

91
00:03:36,949 --> 00:03:34,879
you can get involved with

92
00:03:38,390 --> 00:03:36,959
today on the show we'll talk about a few

93
00:03:39,350 --> 00:03:38,400
but if you want to learn about all of

94
00:03:42,550 --> 00:03:39,360
the opportunities

95
00:03:46,710 --> 00:03:42,560
visit science.nasa.gov citizen

96
00:03:49,589 --> 00:03:46,720
science did you know that planets form

97
00:03:50,630 --> 00:03:49,599
from vast clouds of gas dust and chunks

98
00:03:52,789 --> 00:03:50,640
of rock

99
00:03:54,710 --> 00:03:52,799
clouds that are in the shape of disks

100
00:03:56,229 --> 00:03:54,720
with stars at the center

101
00:03:58,149 --> 00:03:56,239
by searching for stars that are

102
00:04:00,149 --> 00:03:58,159
surrounded by these cloud disks

103
00:04:01,429 --> 00:04:00,159
we can find out where planets are

104
00:04:03,910 --> 00:04:01,439
currently forming

105
00:04:05,429 --> 00:04:03,920
and where other planets probably exist

106
00:04:07,670 --> 00:04:05,439
today

107
00:04:09,910 --> 00:04:07,680
finding these planet-forming disks has

108
00:04:10,470 --> 00:04:09,920
been a major quest of astronomers for

109
00:04:13,270 --> 00:04:10,480
the past

110
00:04:14,550 --> 00:04:13,280
three decades through a project called

111
00:04:17,270 --> 00:04:14,560
disk detective

112
00:04:18,150 --> 00:04:17,280
you can help we're joined today by dr

113
00:04:19,830 --> 00:04:18,160

mark kushner

114
00:04:22,069 --> 00:04:19,840
citizen science officer at nasa

115
00:04:24,230 --> 00:04:22,079
headquarters and citizen scientist

116
00:04:26,230 --> 00:04:24,240
hugo dorantini lucca thank you so much

117
00:04:29,830 --> 00:04:26,240
for being with us today

118
00:04:31,189 --> 00:04:29,840
thanks emily thank you so mark can you

119
00:04:33,110 --> 00:04:31,199
tell us a little bit more about dis

120
00:04:35,909 --> 00:04:33,120
detective why does nasa need help

121
00:04:38,870 --> 00:04:35,919
studying these objects

122
00:04:41,110 --> 00:04:38,880
so nasa has a wonderful problem which is

123
00:04:42,629 --> 00:04:41,120
that we have images of the whole sky in

124
00:04:45,350 --> 00:04:42,639
infrared wavelengths

125
00:04:47,749 --> 00:04:45,360
and the images from nasa's wise mission

126
00:04:50,870 --> 00:04:47,759
the wide field infrared explorer

127
00:04:52,310 --> 00:04:50,880
contained two billion sources and which

128
00:04:54,870 --> 00:04:52,320
of those sources

129
00:04:56,550 --> 00:04:54,880
are the planet-forming disks that's

130
00:04:58,469 --> 00:04:56,560
where we go to

131
00:04:59,990 --> 00:04:58,479
members of the public and ask for their

132
00:05:03,270 --> 00:05:00,000
help figuring out

133
00:05:06,469 --> 00:05:03,280
which of those needles in the haystack

134
00:05:09,350 --> 00:05:06,479
is a real planet-forming disk

135
00:05:10,710 --> 00:05:09,360
wow wow that's that is amazing that real

136
00:05:11,670 --> 00:05:10,720
people can help with this type of

137
00:05:13,990 --> 00:05:11,680
research

138
00:05:14,950 --> 00:05:14,000

um hugo you are one of those people so

139
00:05:16,390 --> 00:05:14,960
what has been the most

140
00:05:18,550 --> 00:05:16,400
exciting part about working on this

141
00:05:21,029 --> 00:05:18,560
project

142
00:05:22,710 --> 00:05:21,039
a farm in this moment is like a

143
00:05:25,350 --> 00:05:22,720
compilation of things since i am

144
00:05:28,390 --> 00:05:25,360
participating since 2014.

145
00:05:29,990 --> 00:05:28,400
the start for me was a final a project

146
00:05:33,350 --> 00:05:30,000
where i was able to

147
00:05:36,629 --> 00:05:33,360
participate and contribute with science

148
00:05:37,990 --> 00:05:36,639
and be engaged at the same time because

149
00:05:40,150 --> 00:05:38,000
i was trying a couple of

150
00:05:42,629 --> 00:05:40,160
things in that point but they were

151
00:05:44,629 --> 00:05:42,639
project fun projects and all but

152
00:05:45,990 --> 00:05:44,639
they were no interaction with science

153
00:05:49,029 --> 00:05:46,000
team for example

154
00:05:51,350 --> 00:05:49,039
and why i started to interact with mark

155
00:05:53,189 --> 00:05:51,360
via twitter in that point i started to

156
00:05:55,590 --> 00:05:53,199
learn about the project and

157
00:05:58,870 --> 00:05:55,600
talk back and forth with the science

158
00:06:01,189 --> 00:05:58,880
thing i was able to be

159
00:06:03,510 --> 00:06:01,199
in interact with the project because

160
00:06:05,590 --> 00:06:03,520
that interaction was engaging

161
00:06:06,710 --> 00:06:05,600
so i was able to contribute at the same

162
00:06:09,350 --> 00:06:06,720
time i was

163
00:06:10,150 --> 00:06:09,360

learning about the project how the

164
00:06:12,070 --> 00:06:10,160
project work

165
00:06:14,629 --> 00:06:12,080
how the people working in the project

166
00:06:18,629 --> 00:06:16,790
that was a very important thing at first

167
00:06:21,110 --> 00:06:18,639
because i didn't much

168
00:06:23,029 --> 00:06:21,120
know much about astronomy at that point

169
00:06:24,469 --> 00:06:23,039
i was able to find astronomy but didn't

170
00:06:27,430 --> 00:06:24,479
know about the subject

171
00:06:28,070 --> 00:06:27,440
so be able to participate and learn and

172
00:06:30,710 --> 00:06:28,080
reach the

173
00:06:32,469 --> 00:06:30,720
discovery like the peter pan thinks from

174
00:06:35,510 --> 00:06:32,479
for this detective was

175
00:06:36,950 --> 00:06:35,520
something huge i was not even thinking

176
00:06:39,990 --> 00:06:36,960
into discovering at that point

177
00:06:42,550 --> 00:06:40,000
maybe i was only thinking participate

178
00:06:44,230 --> 00:06:42,560
and be able to contribute in an active

179
00:06:45,830 --> 00:06:44,240
way

180
00:06:48,629 --> 00:06:45,840
and we've been learning from you too

181
00:06:50,870 --> 00:06:48,639
hugo it's been a wonderful six years

182
00:06:53,110 --> 00:06:50,880
working together with you

183
00:06:54,790 --> 00:06:53,120
i feel so fortunate to be able to meet

184
00:06:56,390 --> 00:06:54,800
the citizen scientists that we've met

185
00:06:57,990 --> 00:06:56,400
through this project

186
00:06:59,670 --> 00:06:58,000
yeah it seems like such a great

187
00:07:01,510 --> 00:06:59,680
community so

188
00:07:02,790 --> 00:07:01,520

can can anyone get involved and help

189
00:07:05,830 --> 00:07:02,800
with this project what sort of

190
00:07:08,790 --> 00:07:05,840
experience do people need

191
00:07:10,790 --> 00:07:08,800
no experience necessary so you just go

192
00:07:13,270 --> 00:07:10,800
to diskdetective.org

193
00:07:14,309 --> 00:07:13,280
there's a short online tutorial in about

194
00:07:16,870 --> 00:07:14,319
five minutes

195
00:07:17,589 --> 00:07:16,880
you're looking at data you're helping

196
00:07:18,710 --> 00:07:17,599
nasa

197
00:07:21,189 --> 00:07:18,720
and you're potentially making

198
00:07:23,430 --> 00:07:21,199
discoveries indeed

199
00:07:24,790 --> 00:07:23,440
and remember you are going to be having

200
00:07:27,990 --> 00:07:24,800
fun while learning so

201
00:07:28,870 --> 00:07:28,000
be patient if the project really caused

202
00:07:31,990 --> 00:07:28,880
you

203
00:07:34,870 --> 00:07:32,000
much time to

204
00:07:37,029 --> 00:07:34,880
learn about more details and different

205
00:07:39,990 --> 00:07:37,039
parts of the project so

206
00:07:41,110 --> 00:07:40,000
have a try and have fun that's awesome

207
00:07:42,390 --> 00:07:41,120
that's such good advice that was

208
00:07:43,830 --> 00:07:42,400
actually going to be my next question

209
00:07:45,110 --> 00:07:43,840
what sort of advice do you have for

210
00:07:47,670 --> 00:07:45,120
people that might be interested in

211
00:07:49,749 --> 00:07:47,680
getting started

212
00:07:51,430 --> 00:07:49,759
in astronomy patient is one of the key

213
00:07:54,390 --> 00:07:51,440

because astronomy has

214
00:07:55,029 --> 00:07:54,400
a lot of different things a lot of tools

215
00:07:59,670 --> 00:07:55,039
and

216
00:08:01,749 --> 00:07:59,680
learn

217
00:08:03,430 --> 00:08:01,759
that passion patience is one of the keys

218
00:08:06,710 --> 00:08:03,440
aside of wanting to

219
00:08:08,309 --> 00:08:06,720
to learn and astronomy has also a huge

220
00:08:11,589 --> 00:08:08,319
variety of things

221
00:08:13,909 --> 00:08:11,599
to study maybe you

222
00:08:15,350 --> 00:08:13,919
will want to know the look of stars

223
00:08:17,350 --> 00:08:15,360
perfect or maybe you

224
00:08:18,790 --> 00:08:17,360
you want to see pretty galaxy there are

225
00:08:22,710 --> 00:08:18,800
also projects for that

226
00:08:26,070 --> 00:08:22,720
astronomy can you have a big

227
00:08:28,150 --> 00:08:26,080
selection of things for you there and

228
00:08:29,189 --> 00:08:28,160
hugo you helped us discover peter pan

229
00:08:34,149 --> 00:08:29,199
discs

230
00:08:36,949 --> 00:08:34,159
still forming planets

231
00:08:37,909 --> 00:08:36,959
so scientists we astronomers thought

232
00:08:40,070 --> 00:08:37,919
that

233
00:08:41,990 --> 00:08:40,080
disks stopped forming planets after

234
00:08:44,149 --> 00:08:42,000
about five million years

235
00:08:46,550 --> 00:08:44,159
but then the citizen scientists at this

236
00:08:48,790 --> 00:08:46,560
detective started finding objects

237
00:08:49,750 --> 00:08:48,800
that were forming that were able to form

238
00:08:53,190 --> 00:08:49,760

planets

239
00:08:53,509 --> 00:08:53,200
about nine or ten times the age of that

240
00:08:56,630 --> 00:08:53,519
so

241
00:09:00,310 --> 00:08:56,640
into the 40 and 50 million year

242
00:09:01,670 --> 00:09:00,320
old age range and uh

243
00:09:02,710 --> 00:09:01,680
you know the astronomy community is

244
00:09:04,949 --> 00:09:02,720
still trying to figure out what that

245
00:09:06,949 --> 00:09:04,959
means so that's pretty exciting

246
00:09:08,630 --> 00:09:06,959
that's amazing that is so cool that new

247
00:09:10,949 --> 00:09:08,640
discoveries have come out of this

248
00:09:12,310 --> 00:09:10,959
um working with with citizens and

249
00:09:14,710 --> 00:09:12,320
scientists

250
00:09:15,829 --> 00:09:14,720
yeah and maybe first people

251
00:09:18,310 --> 00:09:15,839
participating jack

252
00:09:19,430 --> 00:09:18,320
can leave you as some surprise like me

253
00:09:22,389 --> 00:09:19,440
when i was

254
00:09:24,310 --> 00:09:22,399
invited to my local tv station to an

255
00:09:27,590 --> 00:09:24,320
interview about that

256
00:09:30,630 --> 00:09:27,600
um well you became a

257
00:09:33,030 --> 00:09:30,640
a local celebrity for a bit uh

258
00:09:34,710 --> 00:09:33,040
by making a decent science discovery

259
00:09:37,030 --> 00:09:34,720
that is so cool

260
00:09:39,190 --> 00:09:37,040
wow well that's all the time we have

261
00:09:40,710 --> 00:09:39,200
today thank you both so much for joining

262
00:09:48,949 --> 00:09:40,720
us

263
00:09:51,350 --> 00:09:48,959

community

264
00:09:53,030 --> 00:09:51,360
nasa has developed an interactive app

265
00:09:54,949 --> 00:09:53,040
called nemonet

266
00:09:56,949 --> 00:09:54,959
it's used to characterize coral reef

267
00:09:58,710 --> 00:09:56,959
ecosystems around the world with

268
00:10:00,550 --> 00:09:58,720
unprecedented accuracy

269
00:10:02,069 --> 00:10:00,560
today we're joined by 10 year old

270
00:10:05,269 --> 00:10:02,079
citizen scientist

271
00:10:06,230 --> 00:10:05,279
kellen homan and nasa scientist dr vade

272
00:10:08,310 --> 00:10:06,240
triath

273
00:10:10,389 --> 00:10:08,320
to tell us more about this fun project

274
00:10:11,990 --> 00:10:10,399
thank you both for joining us today

275
00:10:14,150 --> 00:10:12,000
ben so can you tell us a little bit more

276
00:10:16,710 --> 00:10:14,160
about nemo net what is it

277
00:10:18,470 --> 00:10:16,720
sure so i invented a technology called

278
00:10:20,230 --> 00:10:18,480
fluid lensing at nasa

279
00:10:22,470 --> 00:10:20,240
and it's the first technique we've had

280
00:10:23,030 --> 00:10:22,480
that can look beneath the ocean waves

281
00:10:25,430 --> 00:10:23,040
and map

282
00:10:27,430 --> 00:10:25,440
corals in 3d so we've been traveling

283
00:10:29,509 --> 00:10:27,440
around the world using drones and this

284
00:10:31,110 --> 00:10:29,519
technique to map corals in 3d

285
00:10:32,949 --> 00:10:31,120
and the really the biggest challenge we

286
00:10:34,550 --> 00:10:32,959
have with all of this data is how to

287
00:10:36,470 --> 00:10:34,560
classify it how do we get

288
00:10:38,069 --> 00:10:36,480

the basic number of how many corals

289
00:10:40,470 --> 00:10:38,079
there are how they're doing as a

290
00:10:42,550 --> 00:10:40,480
function of changing ocean temperatures

291
00:10:44,069 --> 00:10:42,560
and that's where nemonite comes in so we

292
00:10:46,150 --> 00:10:44,079
built a video game

293
00:10:48,150 --> 00:10:46,160
that ties into our super computer and

294
00:10:49,990 --> 00:10:48,160
you can download it and play it on your

295
00:10:51,350 --> 00:10:50,000
iphone or ipad device

296
00:10:53,030 --> 00:10:51,360
and what you're doing in that game is

297
00:10:54,470 --> 00:10:53,040
looking at our data sets that we are

298
00:10:55,269 --> 00:10:54,480
getting from around the world with these

299
00:10:57,430 --> 00:10:55,279
drones

300
00:10:59,350 --> 00:10:57,440
and helping learn about corals at the

301
00:11:02,550 --> 00:10:59,360
same time as coloring them and

302
00:11:04,790 --> 00:11:02,560
feeding data into our super computer wow

303
00:11:06,550 --> 00:11:04,800
this is such a cool idea to get people

304
00:11:09,430 --> 00:11:06,560
involved in this project

305
00:11:10,150 --> 00:11:09,440
um kellen i understand that you've been

306
00:11:12,069 --> 00:11:10,160
working

307
00:11:13,190 --> 00:11:12,079
with on this project so can you tell us

308
00:11:15,110 --> 00:11:13,200
is nemo net more

309
00:11:16,230 --> 00:11:15,120
like a game or is it like school work

310
00:11:19,509 --> 00:11:16,240
and have you learned

311
00:11:20,790 --> 00:11:19,519
science by playing the game it's kind of

312
00:11:22,310 --> 00:11:20,800
it's kind of like a game because it's

313
00:11:23,990 --> 00:11:22,320

not school work you kind of get to do

314
00:11:26,310 --> 00:11:24,000
what you want to do you can

315
00:11:29,030 --> 00:11:26,320
choose where you want to be and what and

316
00:11:31,350 --> 00:11:29,040
what you want to do they're like 2d 3d

317
00:11:32,310 --> 00:11:31,360
and then there's stuff like that that

318
00:11:33,829 --> 00:11:32,320
sounds very fun

319
00:11:35,590 --> 00:11:33,839
what kind of things have you learned

320
00:11:36,550 --> 00:11:35,600
from playing the game

321
00:11:38,630 --> 00:11:36,560
there's a lot of different types of

322
00:11:42,630 --> 00:11:38,640
coral and there are

323
00:11:46,310 --> 00:11:42,640
some key regions that have coral

324
00:11:48,310 --> 00:11:46,320
um they are

325
00:11:49,990 --> 00:11:48,320
you can classify guan the great barrier

326
00:11:53,110 --> 00:11:50,000
reef american samoa

327
00:11:54,710 --> 00:11:53,120
hawaii or puerto rico coral so that

328
00:11:56,710 --> 00:11:54,720
seems like where the most of the coral

329
00:11:59,190 --> 00:11:56,720
is probably

330
00:12:00,870 --> 00:11:59,200
wow i didn't know that so can you show

331
00:12:02,710 --> 00:12:00,880
us kind of how you

332
00:12:04,389 --> 00:12:02,720
how you interact with this app i hear

333
00:12:06,310 --> 00:12:04,399
that you are so good at classifying

334
00:12:07,430 --> 00:12:06,320
coral that you have earned the status of

335
00:12:10,470 --> 00:12:07,440
sea turtle

336
00:12:13,350 --> 00:12:10,480
um was it hard to get to that level

337
00:12:13,750 --> 00:12:13,360
yup i've been playing it for yeah a few

338
00:12:19,190 --> 00:12:13,760

months

339
00:12:20,150 --> 00:12:19,200
coral i have the types of coral on here

340
00:12:25,430 --> 00:12:20,160
i can

341
00:12:27,430 --> 00:12:25,440
of all the quarter types i have what i

342
00:12:31,269 --> 00:12:27,440
what i can classify

343
00:12:33,910 --> 00:12:31,279
and like what they look like so then

344
00:12:34,949 --> 00:12:33,920
i'll get out of that and then we have

345
00:12:38,550 --> 00:12:34,959
the 3d map

346
00:12:40,629 --> 00:12:38,560
to you can like scroll

347
00:12:41,990 --> 00:12:40,639
all the directions you can look from

348
00:12:45,269 --> 00:12:42,000
like all directions

349
00:12:47,430 --> 00:12:45,279
it sounds like you're a pro so ved how

350
00:12:49,190 --> 00:12:47,440
are citizen scientists like kellen and

351
00:12:50,710 --> 00:12:49,200
their work in this app helping us

352
00:12:52,790 --> 00:12:50,720
understand what's what's going on with

353
00:12:55,030 --> 00:12:52,800
coral reefs

354
00:12:57,190 --> 00:12:55,040
uh i mean to put it bluntly they are

355
00:12:58,150 --> 00:12:57,200
changing the world and we have mapped as

356
00:13:00,710 --> 00:12:58,160
of 2020

357
00:13:02,389 --> 00:13:00,720
around six percent of the ocean floor

358
00:13:03,910 --> 00:13:02,399
and one of the reasons why it's so

359
00:13:05,190 --> 00:13:03,920
difficult to map the ocean floor first

360
00:13:06,790 --> 00:13:05,200
is because it's difficult to see

361
00:13:07,829 --> 00:13:06,800
anything beneath ocean waves so our

362
00:13:09,590 --> 00:13:07,839
instrument helps

363
00:13:11,670 --> 00:13:09,600

fix that and reveal that environment in

364
00:13:13,110 --> 00:13:11,680
3d but the second is once you have all

365
00:13:14,550 --> 00:13:13,120
that data it really doesn't mean

366
00:13:16,710 --> 00:13:14,560
anything unless you have

367
00:13:18,230 --> 00:13:16,720
humans come in and help annotate what it

368
00:13:20,629 --> 00:13:18,240
is we're looking at is it

369
00:13:21,350 --> 00:13:20,639
sand are we looking at sea cucumbers sea

370
00:13:23,430 --> 00:13:21,360
grass

371
00:13:25,750 --> 00:13:23,440
corals and it really becomes a

372
00:13:27,670 --> 00:13:25,760
complicated machine learning problem

373
00:13:29,430 --> 00:13:27,680
so when we first created the project we

374
00:13:31,509 --> 00:13:29,440
didn't have a video game in mind we were

375
00:13:33,269 --> 00:13:31,519
purely focused on super computing

376
00:13:34,550 --> 00:13:33,279
and being able to develop the tool to

377
00:13:36,710 --> 00:13:34,560
classify these reefs

378
00:13:38,150 --> 00:13:36,720
but we learned you know that the super

379
00:13:38,629 --> 00:13:38,160
computer results and the machine

380
00:13:40,310 --> 00:13:38,639
learning

381
00:13:42,150 --> 00:13:40,320
outputs were only as good as the

382
00:13:43,509 --> 00:13:42,160
training data we have

383
00:13:44,949 --> 00:13:43,519
at that point you know we thought all

384
00:13:45,990 --> 00:13:44,959
right we have we have an untapped

385
00:13:48,230 --> 00:13:46,000
potential

386
00:13:49,750 --> 00:13:48,240
across the world in our nation as well

387
00:13:51,430 --> 00:13:49,760
with all of these students who are

388
00:13:52,629 --> 00:13:51,440

interested engaged they want to explore

389
00:13:54,629 --> 00:13:52,639
these environments

390
00:13:56,150 --> 00:13:54,639
um it's it's funny that this happened

391
00:13:57,670 --> 00:13:56,160
during the pandemic and a lot of folks

392
00:13:59,509 --> 00:13:57,680
were looking for an activity to do at

393
00:14:01,430 --> 00:13:59,519
home that would be at once educational

394
00:14:03,350 --> 00:14:01,440
and benefit science and that's when we

395
00:14:04,310 --> 00:14:03,360
we decided to launch nemo net on earth

396
00:14:05,990 --> 00:14:04,320
day this year

397
00:14:08,389 --> 00:14:06,000
and so we've we currently have around

398
00:14:10,949 --> 00:14:08,399
100 000 plus active users

399
00:14:11,670 --> 00:14:10,959
kellen is in our in our top 1 of pro

400
00:14:14,829 --> 00:14:11,680
players

401
00:14:15,990 --> 00:14:14,839
he outclassifies phd trained coral reef

402
00:14:19,110 --> 00:14:16,000
biologists

403
00:14:22,470 --> 00:14:19,120
regularly um history name is

404
00:14:23,509 --> 00:14:22,480
admiral crocodile and it's it's really

405
00:14:27,030 --> 00:14:23,519
just amazing

406
00:14:28,949 --> 00:14:27,040
how how quickly um kids in his age group

407
00:14:30,790 --> 00:14:28,959
pick up on classifying this is not an

408
00:14:33,590 --> 00:14:30,800
easy task i struggle with this

409
00:14:35,430 --> 00:14:33,600
you open the game you see a 3d coral

410
00:14:36,629 --> 00:14:35,440
which looks to you know like a loaf of

411
00:14:38,550 --> 00:14:36,639
bread to some people

412
00:14:39,990 --> 00:14:38,560
it can look like very different shapes

413
00:14:42,230 --> 00:14:40,000

kids have to learn what that is

414
00:14:43,030 --> 00:14:42,240
pass an accuracy test while painting in

415
00:14:44,790 --> 00:14:43,040
3d

416
00:14:47,189 --> 00:14:44,800
and that's how they graduate and level

417
00:14:48,949 --> 00:14:47,199
up the food chain in the video game

418
00:14:50,550 --> 00:14:48,959
and all that data then gets compared on

419
00:14:52,790 --> 00:14:50,560
our super computer we can measure its

420
00:14:53,910 --> 00:14:52,800
statistics related to other scientists

421
00:14:56,310 --> 00:14:53,920
inputs other

422
00:14:57,670 --> 00:14:56,320
uh amateur players and it's it's really

423
00:14:59,509 --> 00:14:57,680
the sweet spot we found for

424
00:15:02,710 --> 00:14:59,519
classification is roughly

425
00:15:03,750 --> 00:15:02,720
kellen's age group um and the amount of

426
00:15:05,509 --> 00:15:03,760
time that they play

427
00:15:06,790 --> 00:15:05,519
the the knowledge they have in these

428
00:15:08,470 --> 00:15:06,800
environments is really just

429
00:15:10,710 --> 00:15:08,480
extraordinary so

430
00:15:12,150 --> 00:15:10,720
yeah i'd say we could not do it without

431
00:15:15,189 --> 00:15:12,160
without kids like helen

432
00:15:16,389 --> 00:15:15,199
this is so amazing so uh kellen do you

433
00:15:17,910 --> 00:15:16,399
have any advice for

434
00:15:19,670 --> 00:15:17,920
for people watching that might want to

435
00:15:22,389 --> 00:15:19,680
get involved

436
00:15:24,069 --> 00:15:22,399
yeah i also wanna where i i actually

437
00:15:26,150 --> 00:15:24,079
have the number there have been seven

438
00:15:27,189 --> 00:15:26,160

thousand seven hundred thousand three

439
00:15:30,389 --> 00:15:27,199
hundred

440
00:15:33,110 --> 00:15:30,399
and eighty eight classifications by

441
00:15:36,870 --> 00:15:33,120
everybody who's been playing nemo net

442
00:15:39,590 --> 00:15:36,880
that's amazing and advice is definitely

443
00:15:40,629 --> 00:15:39,600
take your time and like do it one at a

444
00:15:42,230 --> 00:15:40,639
time

445
00:15:43,749 --> 00:15:42,240
and definitely look and make sure you

446
00:15:44,470 --> 00:15:43,759
know what each choral type looks like

447
00:15:47,749 --> 00:15:44,480
because they do give

448
00:15:49,110 --> 00:15:47,759
actual pictures in the game of what the

449
00:15:52,069 --> 00:15:49,120
choral types look like

450
00:15:53,990 --> 00:15:52,079
so that's that helps classify once you

451
00:15:56,389 --> 00:15:54,000
when you can see what the coral type

452
00:15:57,829 --> 00:15:56,399
looks like and then you can put that in

453
00:16:00,949 --> 00:15:57,839
to your knowledge of what so

454
00:16:03,189 --> 00:16:00,959
what we're looking for in the game

455
00:16:04,389 --> 00:16:03,199
this is so cool i am just so impressed

456
00:16:07,430 --> 00:16:04,399
but thank you both

457
00:16:10,310 --> 00:16:07,440
so much for joining us

458
00:16:12,150 --> 00:16:10,320
let's move up into the atmosphere way up

459
00:16:12,790 --> 00:16:12,160
to where the auroras dance across our

460
00:16:14,230 --> 00:16:12,800
skies

461
00:16:16,150 --> 00:16:14,240
in order to track the appearance of

462
00:16:18,389 --> 00:16:16,160
auroras across the globe

463
00:16:19,829 --> 00:16:18,399

nasa supports a citizen science project

464
00:16:22,150 --> 00:16:19,839
called aurorasaurus

465
00:16:23,110 --> 00:16:22,160
where volunteers submit reports and

466
00:16:25,590 --> 00:16:23,120
photographs

467
00:16:27,430 --> 00:16:25,600
through a mobile app and website with

468
00:16:28,150 --> 00:16:27,440
all of this data from users around the

469
00:16:30,310 --> 00:16:28,160
planet

470
00:16:31,430 --> 00:16:30,320
researchers are able to learn more about

471
00:16:33,749 --> 00:16:31,440
this mysterious

472
00:16:35,030 --> 00:16:33,759
and dazzling phenomenon i'm joined by

473
00:16:37,670 --> 00:16:35,040
nasa scientist

474
00:16:38,470 --> 00:16:37,680
dr elizabeth mcdonald and citizen

475
00:16:40,150 --> 00:16:38,480
scientist

476
00:16:42,389 --> 00:16:40,160
donna locke thank you so much for

477
00:16:45,670 --> 00:16:42,399
joining us

478
00:16:48,870 --> 00:16:45,680
hi thank you for including me

479
00:16:51,189 --> 00:16:48,880
hi thanks of course so elizabeth

480
00:16:52,870 --> 00:16:51,199
why is it an important area of research

481
00:16:56,389 --> 00:16:52,880
um to have these citizen scientists

482
00:16:58,949 --> 00:16:56,399
contribute um regarding auroras

483
00:16:59,829 --> 00:16:58,959
yeah so auroras affect our technologies

484
00:17:02,949 --> 00:16:59,839
on earth

485
00:17:04,150 --> 00:17:02,959
and in the sky on in satellites and they

486
00:17:06,549 --> 00:17:04,160
move really quickly

487
00:17:09,270 --> 00:17:06,559
and it's important um to get an

488
00:17:11,429 --> 00:17:09,280

understanding of what they're doing

489
00:17:12,309 --> 00:17:11,439
even when they're really quiet or really

490
00:17:14,150 --> 00:17:12,319
large

491
00:17:15,590 --> 00:17:14,160
and citizen scientists can really help

492
00:17:18,710 --> 00:17:15,600
with that

493
00:17:20,150 --> 00:17:18,720
amazing so donna you um are a citizen

494
00:17:22,390 --> 00:17:20,160
scientist with this project

495
00:17:23,270 --> 00:17:22,400
can you uh kind of walk us through what

496
00:17:26,630 --> 00:17:23,280
contributing

497
00:17:29,990 --> 00:17:26,640
looks like sure um

498
00:17:31,909 --> 00:17:30,000
it's uh what our source wants is

499
00:17:33,990 --> 00:17:31,919
our observations from the ground

500
00:17:35,750 --> 00:17:34,000
wherever we are so we are their boots in

501
00:17:38,070 --> 00:17:35,760
the ground eyes to the sky

502
00:17:39,990 --> 00:17:38,080
and it starts with me watching the

503
00:17:42,630 --> 00:17:40,000
forecast for the aurora

504
00:17:43,590 --> 00:17:42,640
and the solar activity uh listening to

505
00:17:46,549 --> 00:17:43,600
the chatter on

506
00:17:48,710 --> 00:17:46,559
twitter and our facebook groups and when

507
00:17:51,190 --> 00:17:48,720
the conditions are right and the sky is

508
00:17:55,270 --> 00:17:51,200
clear i head out with my camera

509
00:17:59,270 --> 00:17:55,280
and i will take pictures of the aurora

510
00:18:02,310 --> 00:17:59,280
and after that i will report

511
00:18:05,430 --> 00:18:02,320
by going online to aurorasaurus or

512
00:18:08,630 --> 00:18:05,440
on their their app but we would

513
00:18:11,669 --> 00:18:08,640

uh give them our observations and upload

514
00:18:14,070 --> 00:18:11,679
a photo of what we saw on the ground

515
00:18:16,390 --> 00:18:14,080
wow and elizabeth how does that help you

516
00:18:19,990 --> 00:18:16,400
with your research

517
00:18:21,750 --> 00:18:20,000
well knowing um exactly what time it was

518
00:18:23,190 --> 00:18:21,760
and where the person was when they saw

519
00:18:25,190 --> 00:18:23,200
the aurora

520
00:18:26,789 --> 00:18:25,200
allows us to put all of those different

521
00:18:29,270 --> 00:18:26,799
images together

522
00:18:30,230 --> 00:18:29,280
along with our traditional observations

523
00:18:33,669 --> 00:18:30,240
and

524
00:18:37,990 --> 00:18:36,070
in more depth what kind of discoveries

525
00:18:41,430 --> 00:18:38,000
have citizen scientists made

526
00:18:43,750 --> 00:18:41,440
with this project so

527
00:18:44,950 --> 00:18:43,760
one big one is something called steve

528
00:18:47,750 --> 00:18:44,960
which is actually

529
00:18:49,590 --> 00:18:47,760
an aurora that can be seen um further

530
00:18:52,870 --> 00:18:49,600
away from the poles than the usual

531
00:18:56,150 --> 00:18:52,880
aurora so overhead over

532
00:18:58,710 --> 00:18:56,160
southern canada and the northern u.s and

533
00:18:59,990 --> 00:18:58,720
it's very unusual it kind of looks like

534
00:19:03,350 --> 00:19:00,000
an airplane

535
00:19:05,590 --> 00:19:03,360
condensation trail but with a photograph

536
00:19:06,390 --> 00:19:05,600
you can pick up these amazing colors as

537
00:19:08,870 --> 00:19:06,400
well

538
00:19:10,390 --> 00:19:08,880

and by studying it further with

539
00:19:11,909 --> 00:19:10,400
satellite data and

540
00:19:14,150 --> 00:19:11,919
other data from the ground we've

541
00:19:16,950 --> 00:19:14,160
discovered it's it's really like a

542
00:19:17,669 --> 00:19:16,960
flow driven aurora it's an east to west

543
00:19:19,590 --> 00:19:17,679
flow

544
00:19:20,710 --> 00:19:19,600
that is lighting up the sky and doing

545
00:19:23,909 --> 00:19:20,720
some amazing

546
00:19:26,549 --> 00:19:23,919
kind of new unusual aurora

547
00:19:28,789 --> 00:19:26,559
auroral activity that's still being

548
00:19:31,750 --> 00:19:28,799
studied now

549
00:19:32,549 --> 00:19:31,760
wow that is amazing so i've only seen

550
00:19:35,110 --> 00:19:32,559
aurora's in

551
00:19:38,310 --> 00:19:35,120
in videos and images what is it like to

552
00:19:41,909 --> 00:19:38,320
to see it firsthand

553
00:19:43,669 --> 00:19:41,919
my latitude in southern manitoba

554
00:19:45,430 --> 00:19:43,679
it's it just looks like a white light

555
00:19:48,150 --> 00:19:45,440
maybe with a green tint to it

556
00:19:50,390 --> 00:19:48,160
when it's active then sometimes i can

557
00:19:53,510 --> 00:19:50,400
see the pink fringe along the bottom

558
00:19:55,029 --> 00:19:53,520
and sometimes i can also see the red

559
00:19:58,230 --> 00:19:55,039
that goes high above

560
00:20:00,390 --> 00:19:58,240
but uh most of the time it's only about

561
00:20:03,190 --> 00:20:00,400
30 degrees above the horizon where i

562
00:20:03,990 --> 00:20:03,200
am once in a while it will go overhead

563
00:20:10,710 --> 00:20:04,000

and

564
00:20:11,430 --> 00:20:10,720
if we hit a get to a substorm then it

565
00:20:14,870 --> 00:20:11,440
will start

566
00:20:16,390 --> 00:20:14,880
dancing for about 30 seconds to about 20

567
00:20:19,270 --> 00:20:16,400
minutes and that's the very

568
00:20:21,430 --> 00:20:19,280
exciting part that we want to photograph

569
00:20:24,470 --> 00:20:21,440
and after that

570
00:20:27,669 --> 00:20:24,480
is a very subtle um

571
00:20:30,230 --> 00:20:27,679
pulsating yeah pulsating um aurora

572
00:20:31,750 --> 00:20:30,240
that is difficult to actually see with

573
00:20:34,549 --> 00:20:31,760
the eyes but the camera can really

574
00:20:36,789 --> 00:20:34,559
capture it beautifully

575
00:20:38,950 --> 00:20:36,799
that is just amazing and so we only have

576
00:20:40,149 --> 00:20:38,960
a couple seconds left but could you

577
00:20:41,590 --> 00:20:40,159
how do you have a couple pieces of

578
00:20:43,590 --> 00:20:41,600
advice for people that want to get

579
00:20:46,870 --> 00:20:43,600
involved

580
00:20:48,390 --> 00:20:46,880
i would say please join us because it's

581
00:20:50,870 --> 00:20:48,400
it's a very exciting thing to be

582
00:20:53,909 --> 00:20:50,880
involved with to be able to report

583
00:20:55,750 --> 00:20:53,919
uh and share what i see

584
00:20:57,590 --> 00:20:55,760
i'm not a scientist i don't have a great

585
00:20:59,510 --> 00:20:57,600
camera i don't uh

586
00:21:00,870 --> 00:20:59,520
i'm not a professional but i can be

587
00:21:01,510 --> 00:21:00,880
involved in something that's really

588
00:21:02,950 --> 00:21:01,520

important

589
00:21:04,870 --> 00:21:02,960
and right now in this time of social

590
00:21:05,990 --> 00:21:04,880
distancing we're looking for something

591
00:21:08,789 --> 00:21:06,000
to do outside

592
00:21:10,710 --> 00:21:08,799
and we can do this on our own we don't

593
00:21:12,549 --> 00:21:10,720
need to worry about social distancing

594
00:21:14,070 --> 00:21:12,559
and we can link arms with everyone

595
00:21:17,029 --> 00:21:14,080
across the globe

596
00:21:18,470 --> 00:21:17,039
to be a part of something very exciting

597
00:21:20,950 --> 00:21:18,480
like this

598
00:21:23,430 --> 00:21:20,960
yeah virtually we can get together and

599
00:21:24,149 --> 00:21:23,440
also it's really a great bridge between

600
00:21:28,549 --> 00:21:24,159
the

601
00:21:31,830 --> 00:21:28,559
it spurs a lot of great

602
00:21:35,029 --> 00:21:31,840
communication and um questions

603
00:21:37,110 --> 00:21:35,039
about what we're seeing so yeah we

604
00:21:39,909 --> 00:21:37,120
encourage people to join us

605
00:21:40,549 --> 00:21:39,919
be patient the sun we have to wait for

606
00:21:43,110 --> 00:21:40,559
the sun

607
00:21:44,470 --> 00:21:43,120
and the sky to be clear and that can

608
00:21:46,149 --> 00:21:44,480
take a while but

609
00:21:47,669 --> 00:21:46,159
you can join our community and learn

610
00:21:51,350 --> 00:21:47,679
more in the meantime

611
00:21:55,430 --> 00:21:51,360
so everyone is welcome awesome

612
00:21:59,590 --> 00:21:57,190
if you're interested in astronomy and

613
00:22:00,630 --> 00:21:59,600

looking to the sky this next project

614
00:22:03,110 --> 00:22:00,640
might be for you

615
00:22:04,070 --> 00:22:03,120
the international astronomical search

616
00:22:06,310 --> 00:22:04,080
collaboration

617
00:22:07,909 --> 00:22:06,320
also known as isaac is a program that

618
00:22:10,310 --> 00:22:07,919
allows citizen scientists

619
00:22:11,669 --> 00:22:10,320
all around the world to analyze nasa's

620
00:22:13,669 --> 00:22:11,679
high quality data

621
00:22:15,350 --> 00:22:13,679
of near-earth objects things like

622
00:22:17,430 --> 00:22:15,360
asteroids and comets

623
00:22:19,669 --> 00:22:17,440
with this data volunteers are able to

624
00:22:20,549 --> 00:22:19,679
make discoveries of new asteroids in our

625
00:22:22,710 --> 00:22:20,559
solar system

626
00:22:24,630 --> 00:22:22,720
and near earth i'm joined by isaac

627
00:22:27,190 --> 00:22:24,640
founder dr patrick miller

628
00:22:27,990 --> 00:22:27,200
and citizen scientist ludwig aldolfo

629
00:22:32,310 --> 00:22:28,000
fernandez

630
00:22:34,310 --> 00:22:32,320
thank you both for joining us thank you

631
00:22:36,149 --> 00:22:34,320
so patrick this sounds like an exciting

632
00:22:40,470 --> 00:22:36,159
project could you tell us more

633
00:22:41,029 --> 00:22:40,480
about it yes uh we uh we started this

634
00:22:44,710 --> 00:22:41,039
project

635
00:22:47,669 --> 00:22:44,720
in uh in in 2006 i think we had

636
00:22:48,230 --> 00:22:47,679
like five teams participating now we've

637
00:22:50,470 --> 00:22:48,240
got over

638
00:22:52,149 --> 00:22:50,480

3000 teams from 80 countries around the

639
00:22:54,549 --> 00:22:52,159
world to participate

640
00:22:56,230 --> 00:22:54,559
uh we provide images from large

641
00:22:57,350 --> 00:22:56,240
telescopes uh at the university of

642
00:23:00,549 --> 00:22:57,360
hawaii

643
00:23:02,230 --> 00:23:00,559
uh the pan stars uh sky survey and also

644
00:23:03,590 --> 00:23:02,240
the university of arizona the catalina

645
00:23:06,549 --> 00:23:03,600
sky survey

646
00:23:08,549 --> 00:23:06,559
uh we take these images we process them

647
00:23:10,390 --> 00:23:08,559
and then send them out to teams of

648
00:23:12,390 --> 00:23:10,400
citizen scientists around the world

649
00:23:13,510 --> 00:23:12,400
and their job is to look through these

650
00:23:17,270 --> 00:23:13,520
these images

651
00:23:21,110 --> 00:23:17,280
and find discoveries of of asteroids

652
00:23:25,750 --> 00:23:24,070
wow this is really important work um so

653
00:23:26,310 --> 00:23:25,760
ludwing you've been involved with this

654
00:23:28,870 --> 00:23:26,320
project

655
00:23:30,470 --> 00:23:28,880
um can you tell us how how you

656
00:23:34,470 --> 00:23:30,480
participate and what sort of skills

657
00:23:38,070 --> 00:23:37,029
well uh well i managed the campaign for

658
00:23:39,990 --> 00:23:38,080
bolivia it's named

659
00:23:41,909 --> 00:23:40,000
all bolivian as the research campaign

660
00:23:44,390 --> 00:23:41,919
this campaign is pretty neo and we are

661
00:23:46,230 --> 00:23:44,400
working with isaac since 2018

662
00:23:48,149 --> 00:23:46,240
and to this day more than one thousand

663
00:23:50,789 --> 00:23:48,159

students participated in the campaign

664
00:23:51,830 --> 00:23:50,799
there isn't like a list of skills to

665
00:23:53,350 --> 00:23:51,840
participate but

666
00:23:55,750 --> 00:23:53,360
the student needs to meet some

667
00:23:57,350 --> 00:23:55,760
requirements such as having a computer

668
00:23:58,789 --> 00:23:57,360
and have an internet connection

669
00:24:01,190 --> 00:23:58,799
sometimes the school is in charge of

670
00:24:04,310 --> 00:24:01,200
that well but the most important

671
00:24:05,510 --> 00:24:04,320
is to have the desire to learn and to

672
00:24:09,029 --> 00:24:05,520
make to contribute

673
00:24:09,990 --> 00:24:09,039
to observation of asteroids wow okay so

674
00:24:11,510 --> 00:24:10,000
what kind of

675
00:24:14,870 --> 00:24:11,520
observations and discoveries have you

676
00:24:18,390 --> 00:24:16,390
well the living campaign we have made

677
00:24:21,029 --> 00:24:18,400
more than 400 uh

678
00:24:22,390 --> 00:24:21,039
probably preliminar asteroids and seven

679
00:24:23,990 --> 00:24:22,400
provisional asteroids

680
00:24:26,070 --> 00:24:24,000
so as bolivian campaign we also

681
00:24:27,110 --> 00:24:26,080
participated in special campaigns that

682
00:24:29,990 --> 00:24:27,120
are competitive

683
00:24:31,269 --> 00:24:30,000
among the best 10 teams of the world

684
00:24:34,630 --> 00:24:31,279
amazing

685
00:24:36,310 --> 00:24:34,640
so uh dr miller how did does the work of

686
00:24:39,350 --> 00:24:36,320
citizen scientists help with your

687
00:24:42,390 --> 00:24:41,669
the the citizen scientists are are

688
00:24:44,710 --> 00:24:42,400

finding

689
00:24:46,870 --> 00:24:44,720
objects that are actually not reported

690
00:24:48,549 --> 00:24:46,880
by the large sky surveys

691
00:24:50,789 --> 00:24:48,559
their citizen scientists are able to

692
00:24:52,630 --> 00:24:50,799
look at these images and see deeper

693
00:24:54,950 --> 00:24:52,640
into the images than the automated

694
00:24:57,990 --> 00:24:54,960
detection utilities conducted either by

695
00:24:59,750 --> 00:24:58,000
pan stars or catalina so

696
00:25:01,430 --> 00:24:59,760
those are important observations because

697
00:25:03,510 --> 00:25:01,440
they're finding things that are

698
00:25:05,990 --> 00:25:03,520
that are missed in the original in the

699
00:25:07,750 --> 00:25:06,000
original data

700
00:25:09,430 --> 00:25:07,760
wow that is quite incredible what an

701
00:25:11,269 --> 00:25:09,440
important project and it's very cool

702
00:25:12,070 --> 00:25:11,279
that citizen scientists can help with

703
00:25:15,590 --> 00:25:12,080
this

704
00:25:16,870 --> 00:25:15,600
um so what advice do both of you have

705
00:25:20,149 --> 00:25:16,880
for other people that want to get

706
00:25:23,510 --> 00:25:22,070
well from isaac's point of view if you'd

707
00:25:25,990 --> 00:25:23,520
like to participate

708
00:25:27,990 --> 00:25:26,000
you're welcome to come to our website

709
00:25:29,590 --> 00:25:28,000
and we have a registration form and uh

710
00:25:30,549 --> 00:25:29,600
the staff and i will be happy to work

711
00:25:32,710 --> 00:25:30,559
with you

712
00:25:34,149 --> 00:25:32,720
uh it takes a day or two once you uh

713
00:25:35,669 --> 00:25:34,159

send in your interests

714
00:25:39,350 --> 00:25:35,679
uh and then we'll get you set up and

715
00:25:42,549 --> 00:25:39,360
participating before you know it

716
00:25:44,230 --> 00:25:42,559
and it's free yeah

717
00:25:45,830 --> 00:25:44,240
for me is that don't be afraid to apply

718
00:25:48,149 --> 00:25:45,840
it's a great opportunity to make

719
00:25:49,269 --> 00:25:48,159
important discoveries in asteroids so

720
00:25:51,269 --> 00:25:49,279
there is a great

721
00:25:53,110 --> 00:25:51,279
experience it's free and it's open for

722
00:25:55,590 --> 00:25:53,120
everyone

723
00:25:56,870 --> 00:25:55,600
amazing great advice thank you both so

724
00:25:59,110 --> 00:25:56,880
much for the work that you're doing and

725
00:26:01,990 --> 00:25:59,120
for being with us here today

726
00:26:03,990 --> 00:26:02,000
so today we have explored our oceans our

727
00:26:06,789 --> 00:26:04,000
skies and planets that are far

728
00:26:08,870 --> 00:26:06,799
far away and we've learned that you too

729
00:26:11,269 --> 00:26:08,880
can be a scientist from your very own

730
00:26:11,990 --> 00:26:11,279
home let's see how the kids in this next

731
00:26:13,990 --> 00:26:12,000
video

732
00:26:18,549 --> 00:26:14,000
have been contributing to nasa research

733
00:26:22,870 --> 00:26:20,549
nasa has scientists posted all over the

734
00:26:25,190 --> 00:26:22,880
world studying earth's frozen regions

735
00:26:25,909 --> 00:26:25,200
we've got people exploring ice sheets

736
00:26:28,950 --> 00:26:25,919
glaciers

737
00:26:30,070 --> 00:26:28,960
permafrost sea ice snow and even ice on

738
00:26:31,669 --> 00:26:30,080

other planets

739
00:26:36,549 --> 00:26:31,679
but even our top scientists need a

740
00:26:40,630 --> 00:26:38,470
do you like going outside to do science

741
00:26:42,870 --> 00:26:40,640
yeah why

742
00:26:44,149 --> 00:26:42,880
because it's fun yeah what's your

743
00:26:48,870 --> 00:26:44,159
favorite part

744
00:26:52,549 --> 00:26:50,710
we're following the micro explorers that

745
00:26:55,269 --> 00:26:52,559
are helping nasa collect data from their

746
00:26:58,950 --> 00:26:55,279
own backyard

747
00:26:58,960 --> 00:27:04,710
why because it's very rounded

748
00:27:09,269 --> 00:27:07,190
here's the idea students construct a

749
00:27:12,070 --> 00:27:09,279
frost tube that gets put into a hole in

750
00:27:14,070 --> 00:27:12,080
undisturbed and uncompacted soil

751
00:27:15,750 --> 00:27:14,080
during the cold months students will

752
00:27:17,350 --> 00:27:15,760
measure the depth at which water in the

753
00:27:19,190 --> 00:27:17,360
frost tube freezes

754
00:27:20,549 --> 00:27:19,200
indicating that the surrounding soil has

755
00:27:22,310 --> 00:27:20,559
frozen

756
00:27:24,389 --> 00:27:22,320
this is one of many citizen science

757
00:27:26,630 --> 00:27:24,399
projects facilitated by globe

758
00:27:28,310 --> 00:27:26,640
the global learning and observations to

759
00:27:31,510 --> 00:27:28,320
benefit the environment program

760
00:27:31,520 --> 00:27:37,350
how far down is the ice

761
00:27:43,990 --> 00:27:41,110
so is there still liquid in there

762
00:27:46,950 --> 00:27:44,000
it's a worldwide program that so far has

763
00:27:49,029 --> 00:27:46,960

collected over 130 million measurements

764
00:27:51,669 --> 00:27:49,039
from more than 10 million students in

765
00:27:54,789 --> 00:27:51,679
113 countries

766
00:27:56,470 --> 00:27:54,799
are you scientists these measurements

767
00:27:57,269 --> 00:27:56,480
are added to a massive worldwide

768
00:28:00,389 --> 00:27:57,279
database

769
00:28:02,789 --> 00:28:00,399
that's free and open to the public

770
00:28:03,510 --> 00:28:02,799
globe connects my students with the rest

771
00:28:06,470 --> 00:28:03,520
of the world

772
00:28:09,110 --> 00:28:06,480
through science and looking at climate

773
00:28:10,549 --> 00:28:09,120
change and how it's affecting the future

774
00:28:13,110 --> 00:28:10,559
globe teachers like terry are

775
00:28:14,710 --> 00:28:13,120
transforming the way kids see science

776
00:28:17,029 --> 00:28:14,720
and how they'll respond to changes in

777
00:28:21,269 --> 00:28:17,039
their future environment

778
00:28:25,350 --> 00:28:23,110
thank you all for joining us today to

779
00:28:26,630 --> 00:28:25,360
learn about citizen science

780
00:28:28,830 --> 00:28:26,640
if you want to become a citizen

781
00:28:31,830 --> 00:28:28,840
scientist yourself visit

782
00:28:33,590 --> 00:28:31,840
science.nasa.gov citizen science and

783
00:28:34,230 --> 00:28:33,600
explore all of the projects that need

784
00:28:35,830 --> 00:28:34,240
you

785
00:28:37,350 --> 00:28:35,840
there's science that can be done by

786
00:28:39,350 --> 00:28:37,360
anyone anywhere

787
00:28:41,029 --> 00:28:39,360
all across the globe with just a cell

788
00:28:43,669 --> 00:28:41,039

phone or a laptop

789
00:28:44,149 --> 00:28:43,679
you can also follow do nasa science on

790
00:28:46,310 --> 00:28:44,159
twitter

791
00:28:47,269 --> 00:28:46,320
and facebook to stay informed of the

792
00:28:49,669 --> 00:28:47,279
latest updates

793
00:28:51,350 --> 00:28:49,679
and discoveries thank you so much for