



Ask An Astrobiologist



EPISODE 29: FEBRUARY 20TH, 2020
DR. HIROYUKI KUROKAWA



Astrobiology Program

1
00:00:35,100 --> 00:00:32,270

[Music]

2
00:00:38,610 --> 00:00:35,110
greetings friends and fellow earthlings

3
00:00:40,770 --> 00:00:38,620
and welcome to ask an astrobiologist the

4
00:00:43,680 --> 00:00:40,780
show that celebrates the science and

5
00:00:46,710 --> 00:00:43,690
celebrates the scientists in the realm

6
00:00:48,840 --> 00:00:46,720
of astrobiology I'm your host dr. Graham

7
00:00:50,520 --> 00:00:48,850
Lau and some of you may notice that my

8
00:00:52,049 --> 00:00:50,530
voice is a little bit more hoarse for

9
00:00:53,520 --> 00:00:52,059
this episode than it was last time

10
00:00:55,950 --> 00:00:53,530
that's because I've been sick recently

11
00:00:57,810 --> 00:00:55,960
so a big shout out to all of you on

12
00:00:59,400 --> 00:00:57,820
Twitter who gave me some helpful advice

13
00:01:00,600 --> 00:00:59,410

on how to fix a sore throat I really

14

00:01:02,450 --> 00:01:00,610

appreciate it

15

00:01:05,370 --> 00:01:02,460

tea with honey has been super helpful

16

00:01:07,680 --> 00:01:05,380

I'm super excited for today's episode we

17

00:01:09,780 --> 00:01:07,690

have another episode chatting with a

18

00:01:11,670 --> 00:01:09,790

researcher from LC the earth Life

19

00:01:14,400 --> 00:01:11,680

Science Institute so that's gonna be

20

00:01:16,080 --> 00:01:14,410

pretty awesome but first as you know we

21

00:01:19,320 --> 00:01:16,090

have some of our background things to

22

00:01:21,359 --> 00:01:19,330

get through like our background quiz now

23

00:01:23,999 --> 00:01:21,369

you might notice that there's not a

24

00:01:26,880 --> 00:01:24,009

background behind me for this episode I

25

00:01:28,320 --> 00:01:26,890

know we got you there right we're gonna

26

00:01:30,150 --> 00:01:28,330

change things up a little bit moving

27

00:01:32,910 --> 00:01:30,160

forward but we're still gonna keep doing

28

00:01:33,990 --> 00:01:32,920

an image for our background quiz so

29

00:01:36,660 --> 00:01:34,000

right now Mike's gonna bring up the

30

00:01:38,850 --> 00:01:36,670

image from last month's episode showing

31

00:01:41,730 --> 00:01:38,860

a location somewhere in the rip world

32

00:01:45,780 --> 00:01:41,740

relevant to astrobiology in this case

33

00:01:47,370 --> 00:01:45,790

it's Janata Hot Springs in Japan not

34

00:01:50,219 --> 00:01:47,380

only our hot springs really important

35

00:01:51,960 --> 00:01:50,229

for our understanding of the evolution

36

00:01:54,390 --> 00:01:51,970

of life and possibly the origins of life

37

00:01:57,480 --> 00:01:54,400

but also it's a really cool place I've

38

00:02:00,300 --> 00:01:57,490

heard to go take a dip so our winner for

39

00:02:03,090 --> 00:02:00,310

this month is Satoshi Kawa Ichi who won

40

00:02:04,590 --> 00:02:03,100

the contest so thank you to Satoshi as

41

00:02:07,800 --> 00:02:04,600

well as all of you who submitted right

42

00:02:09,449 --> 00:02:07,810

answers for our background quiz we'll

43

00:02:11,670 --> 00:02:09,459

probably change the name a little bit

44

00:02:13,890 --> 00:02:11,680

since it's not a background anymore now

45

00:02:17,340 --> 00:02:13,900

you can see some of my books behind me

46

00:02:20,580 --> 00:02:17,350

we'll have a cool astrobiology relevant

47

00:02:22,560 --> 00:02:20,590

field site quiz in future episodes so

48

00:02:25,410 --> 00:02:22,570

keep an eye out for that the day before

49

00:02:27,660 --> 00:02:25,420

the next episode here in March also as

50

00:02:30,090 --> 00:02:27,670

you know we have our ambassador of the

51
00:02:32,039 --> 00:02:30,100
month every month giving a huge shout

52
00:02:34,319 --> 00:02:32,049
out to someone who in the realm of

53
00:02:35,970 --> 00:02:34,329
Twitter or anywhere in social media has

54
00:02:38,640 --> 00:02:35,980
been a huge fan and friend of the show

55
00:02:40,350 --> 00:02:38,650
and shared about our upcoming episode

56
00:02:42,030 --> 00:02:40,360
and so this month we want to give a

57
00:02:44,640 --> 00:02:42,040
special thanks to my friend Tony

58
00:02:46,920 --> 00:02:44,650
gyah a fellow researcher for blue marble

59
00:02:49,289 --> 00:02:46,930
space institute of science as well as a

60
00:02:52,050 --> 00:02:49,299
research scientist at the earth life

61
00:02:53,729 --> 00:02:52,060
science institute tony shared about this

62
00:02:55,559 --> 00:02:53,739
coming episode it got a bunch of likes

63
00:02:57,089 --> 00:02:55,569

and retweets and we really appreciate

64

00:03:01,410 --> 00:02:57,099

all the support out there in social

65

00:03:03,059 --> 00:03:01,420

media lab for our show so again a big

66

00:03:05,160 --> 00:03:03,069

thanks for tuning in I'm super excited

67

00:03:07,470 --> 00:03:05,170

for this episode it's always cool that

68

00:03:09,149 --> 00:03:07,480

we can just talk across the globe about

69

00:03:11,069 --> 00:03:09,159

astrobiology and all the cool things

70

00:03:11,759 --> 00:03:11,079

going on in understanding our place in

71

00:03:15,240 --> 00:03:11,769

the universe

72

00:03:18,479 --> 00:03:15,250

now this month's guest is dr. Hiroyuki

73

00:03:21,949 --> 00:03:18,489

Kurokawa from Elsi and so I want to say

74

00:03:24,479 --> 00:03:21,959

a big hi to Hiro right now hello Hiro

75

00:03:27,449 --> 00:03:24,489

hello good evening

76

00:03:29,429 --> 00:03:27,459

Tokyo yeah that's right yeah so says

77

00:03:31,890 --> 00:03:29,439

it's a much different time here than is

78

00:03:33,360 --> 00:03:31,900

there across the world so thank you for

79

00:03:35,670 --> 00:03:33,370

joining us here for the show

80

00:03:38,699 --> 00:03:35,680

I know that our guests at home watching

81

00:03:41,009 --> 00:03:38,709

right now on second net org in the NASA

82

00:03:42,420 --> 00:03:41,019

Astrobiology Facebook page are gonna

83

00:03:44,399 --> 00:03:42,430

have a lot of questions about your

84

00:03:47,099 --> 00:03:44,409

career and about your research interests

85

00:03:49,110 --> 00:03:47,109

but I get to speak to you first for a

86

00:03:52,289 --> 00:03:49,120

little bit and ask you some questions

87

00:03:55,770 --> 00:03:52,299

about your life as a scientist and one

88

00:03:58,020 --> 00:03:55,780

thing I like to always do is ask what

89

00:03:59,550 --> 00:03:58,030

got you into the sciences in the first

90

00:04:03,680 --> 00:03:59,560

place what was the very first thing that

91

00:04:07,199 --> 00:04:03,690

motivated you to become a scientist okay

92

00:04:11,069 --> 00:04:07,209

when I was a child I really like to know

93

00:04:15,119 --> 00:04:11,079

about universe from us such as books or

94

00:04:19,589 --> 00:04:15,129

TV shows but actually when I grow up too

95

00:04:21,629 --> 00:04:19,599

high school age my dream was not to

96

00:04:26,029 --> 00:04:21,639

become a scientist my dream was to

97

00:04:30,570 --> 00:04:26,039

become a medical doctor but one day I

98

00:04:33,839 --> 00:04:30,580

read a book about X planets written by a

99

00:04:36,450 --> 00:04:33,849

Japanese professor and I remembered my

100

00:04:38,879 --> 00:04:36,460

passion about universe and I decided to

101
00:04:41,249 --> 00:04:38,889
become a scientist actually that

102
00:04:44,460 --> 00:04:41,259
Professor is now Mike curry after this

103
00:04:46,550 --> 00:04:44,470
ancient sub-indices that's really

104
00:04:48,839 --> 00:04:46,560
incredible to have someone inspire you

105
00:04:49,920 --> 00:04:48,849
start your beard towards science and now

106
00:04:53,580 --> 00:04:49,930
to be a colleague that's it that's

107
00:04:55,270 --> 00:04:53,590
awesome and so I've actually

108
00:04:56,740 --> 00:04:55,280
unfortunately never been to L

109
00:05:00,070 --> 00:04:56,750
see I haven't had a chance to visit yet

110
00:05:01,510 --> 00:05:00,080
I really like to what is it like at LC

111
00:05:06,730 --> 00:05:01,520
in Japan working at this really awesome

112
00:05:09,580 --> 00:05:06,740
research institution yes is in Tokyo and

113
00:05:12,159 --> 00:05:09,590

there are lots of scientists from

114

00:05:17,129 --> 00:05:12,169

different here including the planetary

115

00:05:22,480 --> 00:05:17,139

science like me and also chemists bio

116

00:05:27,460 --> 00:05:22,490

chemist etc and we were interested in

117

00:05:30,490 --> 00:05:27,470

how the earth formed and how life

118

00:05:34,690 --> 00:05:30,500

emerged on us and also we are interested

119

00:05:36,460 --> 00:05:34,700

in are there any life in universe it's a

120

00:05:39,670 --> 00:05:36,470

you know the biggest question in the

121

00:05:41,409 --> 00:05:39,680

astrobiology that's why that's awesome

122

00:05:43,510 --> 00:05:41,419

yeah I do want to give a shout out real

123

00:05:46,360 --> 00:05:43,520

quick to the astrobiology Australasia

124

00:05:49,240 --> 00:05:46,370

meeting happening in Tokyo at LC later

125

00:05:52,150 --> 00:05:49,250

this year as well as LC is supporting AB

126
00:05:53,350 --> 00:05:52,160
Brad comm 2020 this year so graduate

127
00:05:55,690 --> 00:05:53,360
students and postdocs keep an eye out

128
00:05:57,070 --> 00:05:55,700
for that you can apply now submit your

129
00:06:00,880 --> 00:05:57,080
abstracts and have a chance to go visit

130
00:06:02,590 --> 00:06:00,890
LLC in Tokyo so let's get talking about

131
00:06:04,930 --> 00:06:02,600
your research a little bit I understand

132
00:06:07,210 --> 00:06:04,940
so your primary research is mostly using

133
00:06:08,590 --> 00:06:07,220
modeling to understand the vocation and

134
00:06:15,159 --> 00:06:08,600
evolution of planets can you talk a bit

135
00:06:19,180 --> 00:06:15,169
about what you do yeah I'm studying run

136
00:06:21,850 --> 00:06:19,190
it formed and change its environment

137
00:06:26,860 --> 00:06:21,860
through time by using the modeling

138
00:06:31,360 --> 00:06:26,870

computer the simulations my research

139

00:06:35,909 --> 00:06:31,370

target's include extrasolar planet as

140

00:06:41,710 --> 00:06:35,919

well as solar system planets many as

141

00:06:48,360 --> 00:06:41,720

Venus Mars and also I study asteroids in

142

00:06:51,370 --> 00:06:48,370

our solar system but know that I also

143

00:06:54,190 --> 00:06:51,380

working with some space exploration

144

00:06:57,010 --> 00:06:54,200

missions yeah I understand that you've

145

00:06:58,719 --> 00:06:57,020

been involved with Hayabusa - yeah which

146

00:07:00,820 --> 00:06:58,729

some of our art get our audience might

147

00:07:03,040 --> 00:07:00,830

know has gone to the asteroid where you

148

00:07:05,560 --> 00:07:03,050

go and is returning a sample to earth

149

00:07:08,710 --> 00:07:05,570

for us to study what is your involvement

150

00:07:13,990 --> 00:07:08,720

with Hayabusa - bin yeah

151

00:07:17,680 --> 00:07:14,000

I have been working on the remote

152

00:07:20,200 --> 00:07:17,690

sensing data obtained from high observe

153

00:07:25,660 --> 00:07:20,210

two spacecraft which is a data about

154

00:07:28,840 --> 00:07:25,670

asteroids named enugu and i arised data

155

00:07:32,860 --> 00:07:28,850

to actually this select the good press

156

00:07:37,450 --> 00:07:32,870

to get the sample from the surface of

157

00:07:40,150 --> 00:07:37,460

asteroids legal and so far the high

158

00:07:43,840 --> 00:07:40,160

obstructive successfully correct its

159

00:07:47,950 --> 00:07:43,850

sampler and now on the way to already

160

00:07:50,260 --> 00:07:47,960

done to to us it's really cool I'm

161

00:07:52,210 --> 00:07:50,270

excited for it to come back it's really

162

00:07:54,910 --> 00:07:52,220

cool you know with ryugu and with been

163

00:07:57,910 --> 00:07:54,920

new we see that asteroids aren't nice

164

00:08:00,100 --> 00:07:57,920

soft flat objects they had lots of

165

00:08:01,840 --> 00:08:00,110

structure to them how did you help to

166

00:08:07,270 --> 00:08:01,850

choose the right area to take take a

167

00:08:10,800 --> 00:08:07,280

sample for Hayabusa 2 yeah because the

168

00:08:13,810 --> 00:08:10,810

main interests of Hayabusa 2 is to find

169

00:08:20,040 --> 00:08:13,820

the evidence of alberta and also the

170

00:08:31,780 --> 00:08:28,240

to us i chose a good place to find a

171

00:08:34,630 --> 00:08:31,790

better amount of water early date in the

172

00:08:35,909 --> 00:08:34,640

mineral as well as apple annex grow

173

00:08:38,560 --> 00:08:35,919

media aspect or our dinner

174

00:08:41,350 --> 00:08:38,570

that's very cool but we really excited

175

00:08:42,610 --> 00:08:41,360

that sample back then I understand

176

00:08:45,700 --> 00:08:42,620

you're also involved with the upcoming

177

00:08:49,600 --> 00:08:45,710

MMX mission yeah speak about what the

178

00:08:54,100 --> 00:08:49,610

plan is for that mission yeah the MMX

179

00:09:01,780 --> 00:08:54,110

mission is masha sample return mission

180

00:09:07,180 --> 00:09:01,790

and that will be launched in 2024 and we

181

00:09:13,960 --> 00:09:07,190

send a spacecraft to much a moon Phobos

182

00:09:17,140 --> 00:09:13,970

and get some sample this is a mission to

183

00:09:19,420 --> 00:09:17,150

understand the origin of the two Russian

184

00:09:20,010 --> 00:09:19,430

moons Phobos and Deimos because though

185

00:09:22,940 --> 00:09:20,020

two

186

00:09:28,290 --> 00:09:22,950

are so mysterious compared to the moon

187

00:09:32,670 --> 00:09:28,300

orbiting our us to Raja Muda so smooth

188

00:09:36,540 --> 00:09:32,680

and looks like so crusty after all so we

189

00:09:40,680 --> 00:09:36,550

directly know it's reading and that will

190

00:09:44,970 --> 00:09:40,690

be a little too hard planets from and

191

00:09:49,530 --> 00:09:44,980

how planets get some important component

192

00:09:52,590 --> 00:09:49,540

to develop right such as water and

193

00:09:54,780 --> 00:09:52,600

organics that's very cool I recall some

194

00:09:56,400 --> 00:09:54,790

years ago another mission was attempted

195

00:09:58,130 --> 00:09:56,410

called the fobos-grunt mission from the

196

00:10:02,250 --> 00:09:58,140

ross cosmos the russian space agency

197

00:10:04,079 --> 00:10:02,260

which unfortunately failed in orbit one

198

00:10:06,570 --> 00:10:04,089

thing i love with that is we had sent

199

00:10:09,060 --> 00:10:06,580

along in that that craft the Planetary

200

00:10:11,100 --> 00:10:09,070

Society had sent along a little disc

201
00:10:13,019 --> 00:10:11,110
called the life disk that had some

202
00:10:16,290 --> 00:10:13,029
tearing organisms on it to go to Phobos

203
00:10:18,600 --> 00:10:16,300
and come back do you know if anyone has

204
00:10:21,510 --> 00:10:18,610
thought sending along any biological

205
00:10:22,949 --> 00:10:21,520
material with MMS or if there's a chance

206
00:10:25,380 --> 00:10:22,959
that when the spacecraft comes back we

207
00:10:27,210 --> 00:10:25,390
could sample any leftover residual earth

208
00:10:33,410 --> 00:10:27,220
organisms from the spacecraft or is that

209
00:10:41,069 --> 00:10:33,420
not really a concept right now to the

210
00:10:47,329 --> 00:10:41,079
BIOS castings we may succeed to sample

211
00:10:52,710 --> 00:10:47,339
some deposited life previously exist on

212
00:10:56,190 --> 00:10:52,720
Mars because the the surface of the

213
00:11:00,350 --> 00:10:56,200

maximum force would be somehow polluted

214

00:11:03,960 --> 00:11:00,360

by the the the ejecta launched from

215

00:11:08,160 --> 00:11:03,970

Martian surface due to some absolute the

216

00:11:11,610 --> 00:11:08,170

impact through the history so we

217

00:11:14,699 --> 00:11:11,620

interact in some bring back some the

218

00:11:17,280 --> 00:11:14,709

host unit life that might have any

219

00:11:18,960 --> 00:11:17,290

system or that's a really cool idea I

220

00:11:21,900 --> 00:11:18,970

really I hadn't even thought of that you

221

00:11:23,699 --> 00:11:21,910

know we talked about how our moon likely

222

00:11:25,620 --> 00:11:23,709

has some residual organisms from early

223

00:11:26,360 --> 00:11:25,630

in Earth's history that were thrown off

224

00:11:28,340 --> 00:11:26,370

of the earth and

225

00:11:29,870 --> 00:11:28,350

to our moon I guess you're right it

226

00:11:32,900 --> 00:11:29,880

makes complete sense that Phobos and

227

00:11:35,750 --> 00:11:32,910

Deimos might have some residual Martian

228

00:11:37,250 --> 00:11:35,760

organisms or at least biota that fell

229

00:11:39,590 --> 00:11:37,260

onto them from long ago had things

230

00:11:42,260 --> 00:11:39,600

crashed there that's really cool to

231

00:11:44,720 --> 00:11:42,270

think about so we have we have some time

232

00:11:46,850 --> 00:11:44,730

here for to talk a little bit I'm kind

233

00:11:49,730 --> 00:11:46,860

of curious if you saw a recent article

234

00:11:52,370 --> 00:11:49,740

that came out where a researcher in the

235

00:11:55,130 --> 00:11:52,380

UK had said that there was a certainty

236

00:11:58,010 --> 00:11:55,140

as she put it a racing certainty that

237

00:12:00,829 --> 00:11:58,020

there was life in Europa and most likely

238

00:12:02,210 --> 00:12:00,839

ancient life on Mars what do you think

239

00:12:04,760 --> 00:12:02,220

about that do you think we can say with

240

00:12:07,850 --> 00:12:04,770

such certainty that there was life in

241

00:12:10,100 --> 00:12:07,860

Europa there was life on Mars or do we

242

00:12:11,150 --> 00:12:10,110

just not know yet how do you how do you

243

00:12:16,010 --> 00:12:11,160

answer that kind of question

244

00:12:19,910 --> 00:12:16,020

oh well it's a difficult question we

245

00:12:23,920 --> 00:12:19,920

cannot say we are sure that there was a

246

00:12:31,310 --> 00:12:23,930

life oh there is a life only a rope our

247

00:12:34,940 --> 00:12:31,320

morals but because the organic materials

248

00:12:39,350 --> 00:12:34,950

which is a be reading books over ayah if

249

00:12:42,650 --> 00:12:39,360

I would say ubiquitous within the solar

250

00:12:45,440 --> 00:12:42,660

city there to be a potential to have

251
00:12:52,550 --> 00:12:45,450
arrived so that would be my question my

252
00:12:54,650 --> 00:12:52,560
answer so I'm also curious - so you do

253
00:12:58,940 --> 00:12:54,660
modelling not just on Venus on Earth and

254
00:13:01,040 --> 00:12:58,950
Mars but also on exoplanets so here's

255
00:13:04,460 --> 00:13:01,050
here's kind of a fun question do you

256
00:13:06,740 --> 00:13:04,470
think our solar system is rare in having

257
00:13:10,400 --> 00:13:06,750
for terrestrial worlds close into our

258
00:13:12,860 --> 00:13:10,410
star with gas giants much further out or

259
00:13:14,870 --> 00:13:12,870
do you think we just haven't found other

260
00:13:16,960 --> 00:13:14,880
solar systems like our own yet and that

261
00:13:23,350 --> 00:13:16,970
there probably are a bunch out there

262
00:13:29,600 --> 00:13:23,360
okay um the the my answer is I think our

263
00:13:34,340 --> 00:13:29,610

surahs it is a bit earlier case in the

264

00:13:36,500 --> 00:13:34,350

whole primary systems actually the

265

00:13:40,180 --> 00:13:36,510

people with presidential a techniques

266

00:13:43,090 --> 00:13:40,190

it's really hard to find

267

00:13:46,119 --> 00:13:43,100

our sights planet orbiting in the

268

00:13:50,740 --> 00:13:46,129

habitable zone around the solar texture

269

00:13:56,290 --> 00:13:50,750

but we have already found that where we

270

00:14:01,569 --> 00:13:56,300

found crater system which has a Jupiter

271

00:14:06,129 --> 00:14:01,579

other giant planets in many cases that

272

00:14:06,730 --> 00:14:06,139

system contain a planet apparently

273

00:14:11,740 --> 00:14:06,740

called

274

00:14:21,129 --> 00:14:11,750

super earth which is a bit raddest Najib

275

00:14:24,369 --> 00:14:21,139

Razak of Planet cross to their to their

276

00:14:27,699 --> 00:14:24,379

dad stir the whole sister and such kind

277

00:14:30,730 --> 00:14:27,709

of super earth doesn't exist in our

278

00:14:33,400 --> 00:14:30,740

solar system so in that respect I would

279

00:14:33,929 --> 00:14:33,410

say our solar system is somehow a real

280

00:14:36,699 --> 00:14:33,939

case

281

00:14:38,980 --> 00:14:36,709

ok awesome that's really interesting I

282

00:14:41,290 --> 00:14:38,990

think I once had a class in planetary

283

00:14:42,850 --> 00:14:41,300

science with Nick Schneider at the

284

00:14:45,809 --> 00:14:42,860

University of Colorado Boulder where I'm

285

00:14:48,819 --> 00:14:45,819

located and he made a really interesting

286

00:14:50,800 --> 00:14:48,829

comment that everything that he thought

287

00:14:52,569 --> 00:14:50,810

he knew about planetary science changed

288

00:14:54,069 --> 00:14:52,579

once we started finding exoplanets and

289

00:14:55,509 --> 00:14:54,079

so it always makes me wonder you know

290

00:14:57,280 --> 00:14:55,519

like when we find something new tomorrow

291

00:14:59,439 --> 00:14:57,290

that changes everything we think or will

292

00:15:01,120 --> 00:14:59,449

it will we be surprised yet again that

293

00:15:04,449 --> 00:15:01,130

things are what we think and such just

294

00:15:05,889 --> 00:15:04,459

it's an interesting thing to consider so

295

00:15:07,870 --> 00:15:05,899

we do have some time before we open it

296

00:15:09,220 --> 00:15:07,880

up to audience questions I want to

297

00:15:11,050 --> 00:15:09,230

remind the audience right now that you

298

00:15:14,499 --> 00:15:11,060

can start asking questions right now for

299

00:15:16,269 --> 00:15:14,509

hero in the second net chat or on the

300

00:15:17,710 --> 00:15:16,279

NASA Astrobiology Facebook page if

301
00:15:19,990 --> 00:15:17,720
you're watching they're just in the chat

302
00:15:22,150 --> 00:15:20,000
area the comment area beside of the

303
00:15:23,829 --> 00:15:22,160
video you can drop some questions right

304
00:15:25,389 --> 00:15:23,839
now and we'll get those into the queue

305
00:15:27,189 --> 00:15:25,399
we do have a lot of questions and so

306
00:15:30,129 --> 00:15:27,199
I'll work on getting into those pretty

307
00:15:31,360 --> 00:15:30,139
soon before we move on a bit about your

308
00:15:33,670 --> 00:15:31,370
personal life and kind of things that

309
00:15:36,040 --> 00:15:33,680
you're interested in here oh I'd like if

310
00:15:37,720 --> 00:15:36,050
you don't mind kind of explaining your

311
00:15:41,290 --> 00:15:37,730
day-to-day research what your work

312
00:15:46,740 --> 00:15:41,300
actually entails in doing modeling and

313
00:15:50,590 --> 00:15:46,750

computer simulations okay um in my

314

00:15:53,860 --> 00:15:50,600

computer simulation you know I simulate

315

00:15:57,449 --> 00:15:53,870

the the example the

316

00:16:01,329 --> 00:15:57,459

the process which formed products in a

317

00:16:07,900 --> 00:16:01,339

protoplanetary disk which is disk of gas

318

00:16:13,809 --> 00:16:07,910

and dust around aster and I shimrit how

319

00:16:18,699 --> 00:16:13,819

gas and dust moves around that host star

320

00:16:23,340 --> 00:16:18,709

and in the simulation does accumulate

321

00:16:28,739 --> 00:16:23,350

onto the the primary

322

00:16:33,069 --> 00:16:28,749

embryo and we can predict other

323

00:16:35,410 --> 00:16:33,079

fractions and many budget are no

324

00:16:40,439 --> 00:16:35,420

parameters what kind of pressure system

325

00:16:43,900 --> 00:16:40,449

can home and by comparing the resultant

326

00:16:52,049 --> 00:16:43,910

primary system in our model to actually

327

00:17:02,439 --> 00:16:58,619

observation studies I trying to

328

00:17:06,929 --> 00:17:02,449

constrain the the actual process which

329

00:17:12,000 --> 00:17:06,939

hold planets and even I am trying to

330

00:17:16,389 --> 00:17:12,010

predict the the the the freakish

331

00:17:19,860 --> 00:17:16,399

frequency of smaller threads which we

332

00:17:25,059 --> 00:17:19,870

cannot detect with a current technique

333

00:17:26,340 --> 00:17:25,069

that I mean that's awesome so so fir for

334

00:17:28,899 --> 00:17:26,350

our viewers at home

335

00:17:31,779 --> 00:17:28,909

so are you like testing like different

336

00:17:33,190 --> 00:17:31,789

concentrations of metals and I guess

337

00:17:35,919 --> 00:17:33,200

astronomers say metals for anything

338

00:17:39,370 --> 00:17:35,929

that's not hydrogen or helium but larger

339

00:17:41,799 --> 00:17:39,380

elements like things like iron and even

340

00:17:43,630 --> 00:17:41,809

heavier elements within a pro solar

341

00:17:50,230 --> 00:17:43,640

nebula and how that can form various

342

00:17:53,080 --> 00:17:50,240

types of planets yeah the that we call

343

00:17:55,600 --> 00:17:53,090

the the amount of metal as a matter s T

344

00:17:59,310 --> 00:17:55,610

and that is a well the most important

345

00:18:05,159 --> 00:17:59,320

parameter to determine the resultant

346

00:18:07,360 --> 00:18:05,169

primary system in your theory but also

347

00:18:08,950 --> 00:18:07,370

who don't the

348

00:18:12,370 --> 00:18:08,960

surprise observation people have already

349

00:18:15,780 --> 00:18:12,380

found some correlation between the host

350

00:18:19,480 --> 00:18:15,790

star Mehta receive is the frequency of

351

00:18:22,660 --> 00:18:19,490

giant planets so by looking at such kind

352

00:18:25,140 --> 00:18:22,670

of coordination comparing with modern we

353

00:18:28,060 --> 00:18:25,150

can and concerning a state process which

354

00:18:30,400 --> 00:18:28,070

determine the outcome right formation

355

00:18:32,350 --> 00:18:30,410

you know it's so cool

356

00:18:35,050 --> 00:18:32,360

a lot of times I get into conversations

357

00:18:36,820 --> 00:18:35,060

with people about how early in the

358

00:18:39,850 --> 00:18:36,830

history of the universe planets may have

359

00:18:42,130 --> 00:18:39,860

formed specifically planets like

360

00:18:44,470 --> 00:18:42,140

terrestrial worlds or worlds with oceans

361

00:18:46,020 --> 00:18:44,480

worlds that we think might have life

362

00:18:49,210 --> 00:18:46,030

like life as we know it

363

00:18:50,710 --> 00:18:49,220

how early then do you think that there

364

00:18:53,650 --> 00:18:50,720

was enough metallicity enough other

365

00:18:56,920 --> 00:18:53,660

stuff besides hydrogen and helium for

366

00:18:59,260 --> 00:18:56,930

the earliest planets to form in our

367

00:19:04,240 --> 00:18:59,270

universe worlds like Earth and Venus and

368

00:19:06,700 --> 00:19:04,250

Mars that is really great question in

369

00:19:09,280 --> 00:19:06,710

the first generation of the studs there

370

00:19:13,810 --> 00:19:09,290

would be only hydrogen Harry made some

371

00:19:20,290 --> 00:19:13,820

regime so around that kind of the first

372

00:19:23,410 --> 00:19:20,300

generation we would not have passed rock

373

00:19:26,650 --> 00:19:23,420

prax because we eat you know the shitty

374

00:19:30,340 --> 00:19:26,660

coast in Cabo lots of different elements

375

00:19:35,730 --> 00:19:30,350

but as we go to the second date short

376

00:19:39,600 --> 00:19:35,740

generation the UN Terry I think starts

377

00:19:44,500 --> 00:19:39,610

started who to form a strike planets

378

00:19:47,290 --> 00:19:44,510

around them so it's bit difficult to say

379

00:19:49,660 --> 00:19:47,300

the exact time where we bend the

380

00:19:52,510 --> 00:19:49,670

universe start to for abstract planets

381

00:19:55,360 --> 00:19:52,520

but I would say we need a second or

382

00:19:57,040 --> 00:19:55,370

third generation of stars and it's

383

00:19:58,900 --> 00:19:57,050

awesomeness so I was interesting to

384

00:20:01,240 --> 00:19:58,910

think about you know when could life

385

00:20:02,950 --> 00:20:01,250

have started in our universe or in our

386

00:20:04,930 --> 00:20:02,960

galaxy based on the kinds of planets we

387

00:20:06,850 --> 00:20:04,940

had so it seems like your research is

388

00:20:09,730 --> 00:20:06,860

really crucial to maybe trying to answer

389

00:20:11,890 --> 00:20:09,740

that kind of question so I do and remind

390

00:20:13,540 --> 00:20:11,900

our audience again we do have a lot of

391

00:20:15,580 --> 00:20:13,550

questions already but please don't let

392

00:20:17,110 --> 00:20:15,590

that deter you you can still keep asking

393

00:20:20,150 --> 00:20:17,120

questions I'll jump over to audience

394

00:20:23,060 --> 00:20:20,160

questions here very soon for for

395

00:20:26,060 --> 00:20:23,070

dr. Kurokawa but first here oh I'd like

396

00:20:28,520 --> 00:20:26,070

to chat a bit about your life outside of

397

00:20:30,080 --> 00:20:28,530

science so for instance I understand

398

00:20:32,960 --> 00:20:30,090

that you enjoyed like seeing wild

399

00:20:34,310 --> 00:20:32,970

animals and going to zoos and doing

400

00:20:39,980 --> 00:20:34,320

photography of animals where did that

401
00:20:44,750 --> 00:20:39,990
passion come from yeah I like to go to

402
00:20:49,160 --> 00:20:44,760
see animals even to see the right animal

403
00:20:51,640 --> 00:20:49,170
assists in some national parks and well

404
00:20:56,270 --> 00:20:51,650
I don't know the exact reason but the

405
00:20:58,580 --> 00:20:56,280
violin reason could be because I'm

406
00:21:02,710 --> 00:20:58,590
merely working with the computer

407
00:21:05,180 --> 00:21:02,720
modeling analyzing data sent from the

408
00:21:11,390 --> 00:21:05,190
spacecraft in my home feeds

409
00:21:15,220 --> 00:21:11,400
I like to go outside when I am NOT in my

410
00:21:20,690 --> 00:21:15,230
office that could be a real reason and

411
00:21:27,680 --> 00:21:20,700
also I don't know if this is reason but

412
00:21:34,250 --> 00:21:27,690
when I wrote why the animals in nature I

413
00:21:37,400 --> 00:21:34,260

always impressed how the nature it's

414

00:21:40,310 --> 00:21:37,410

complex and it already reminded me that

415

00:21:43,690 --> 00:21:40,320

the the computer modeling things only

416

00:21:47,630 --> 00:21:43,700

capture the tiny part of us in nature so

417

00:21:52,340 --> 00:21:47,640

it remind me such kind of the modeling

418

00:21:58,040 --> 00:21:52,350

always means some tiny but the important

419

00:22:01,160 --> 00:21:58,050

part would over the nature another

420

00:22:03,530 --> 00:22:01,170

interesting point our models are just

421

00:22:05,810 --> 00:22:03,540

how we try to approximate what nature is

422

00:22:08,270 --> 00:22:05,820

doing but nature is always a bit beyond

423

00:22:09,560 --> 00:22:08,280

our models right I love the idea of just

424

00:22:11,540 --> 00:22:09,570

getting out of your office I had a lot

425

00:22:12,620 --> 00:22:11,550

of friends in graduate school who did

426
00:22:13,910 --> 00:22:12,630
theoretical work and they were

427
00:22:15,500 --> 00:22:13,920
constantly on their computers and a lot

428
00:22:17,030 --> 00:22:15,510
of them love to go out and just go on

429
00:22:19,820 --> 00:22:17,040
vacation and you can do things to get

430
00:22:23,240 --> 00:22:19,830
away from their office so if I if I have

431
00:22:25,130 --> 00:22:23,250
a chance to come visit Tokyo for AM 2020

432
00:22:27,620 --> 00:22:25,140
or at grad Khan 2020

433
00:22:30,520 --> 00:22:27,630
what is the one Zoo you would recommend

434
00:22:32,360 --> 00:22:30,530
to a guest they have to go see near yeah

435
00:22:37,940 --> 00:22:32,370
yeah

436
00:22:41,510 --> 00:22:37,950
there is big code we know sue and I

437
00:22:45,019 --> 00:22:41,520
fricking it I frequently visit to

438
00:22:46,070 --> 00:22:45,029

dissolve you can also enjoy awesome I

439

00:22:47,690 --> 00:22:46,080

love it

440

00:22:50,750 --> 00:22:47,700

so if I have a chance to come or if we

441

00:22:54,159 --> 00:22:50,760

have to check that out I also understand

442

00:22:57,519 --> 00:22:54,169

that you also are a big fan of baseball

443

00:23:04,130 --> 00:22:57,529

yes actually that the base for is really

444

00:23:09,139 --> 00:23:04,140

actually it's a most popular sports in

445

00:23:14,210 --> 00:23:09,149

Japan and because I'm from the Hokkaido

446

00:23:19,460 --> 00:23:14,220

it's another part of the Japan I big

447

00:23:24,409 --> 00:23:19,470

from the Hokkaido fighters and way I

448

00:23:28,669 --> 00:23:24,419

have time I sometimes go to watch babes

449

00:23:30,110 --> 00:23:28,679

war games in the studying that's awesome

450

00:23:32,120 --> 00:23:30,120

I think you know it's always good for

451
00:23:34,190 --> 00:23:32,130
people remember that that all scientists

452
00:23:36,500 --> 00:23:34,200
also have a life outside of the

453
00:23:37,730 --> 00:23:36,510
laboratory away from the computer away

454
00:23:40,399 --> 00:23:37,740
from the telescope away from the

455
00:23:42,230 --> 00:23:40,409
microscope we also do other things so

456
00:23:44,570 --> 00:23:42,240
that's really cool and I will definitely

457
00:23:45,950 --> 00:23:44,580
have to come visit that zoo and take in

458
00:23:49,130 --> 00:23:45,960
so the natural wildlife if I get a

459
00:23:51,169 --> 00:23:49,140
chance to visit so I am going to open it

460
00:23:52,909 --> 00:23:51,179
up to the audience questions now so

461
00:23:55,220 --> 00:23:52,919
remember you can ask your questions on

462
00:23:58,010 --> 00:23:55,230
the second net Borg or on the NASA

463
00:23:59,330 --> 00:23:58,020

Astrobiology Facebook page or if you'd

464

00:24:01,070 --> 00:23:59,340

like you can also jump over to Twitter

465

00:24:03,950 --> 00:24:01,080

right now and pop in a question there

466

00:24:05,600 --> 00:24:03,960

using hashtag ask Astro bio that hashtag

467

00:24:08,200 --> 00:24:05,610

lets us track the questions a little

468

00:24:11,779 --> 00:24:08,210

easier so we're going to start off with

469

00:24:15,139 --> 00:24:11,789

a question from dr. Jim pass of the

470

00:24:19,820 --> 00:24:15,149

Astro sociology Research Institute god

471

00:24:21,289 --> 00:24:19,830

yes an interesting question Jim wants to

472

00:24:23,090 --> 00:24:21,299

know do you think it will make a

473

00:24:25,190 --> 00:24:23,100

difference to some individuals

474

00:24:28,130 --> 00:24:25,200

categories or social groups here on

475

00:24:31,279 --> 00:24:28,140

earth if it was proved that human life

476

00:24:36,110 --> 00:24:31,289

came from Mars or elsewhere rather than

477

00:24:39,590 --> 00:24:36,120

developing here on earth oh it's it's a

478

00:24:43,610 --> 00:24:39,600

difficult question I'll this means their

479

00:24:44,409 --> 00:24:43,620

life came from us or else we are a form

480

00:24:51,159 --> 00:24:44,419

of

481

00:24:52,930 --> 00:24:51,169

group that's how I'm reading his

482

00:24:55,570 --> 00:24:52,940

question I think he's asking you what

483

00:24:58,299 --> 00:24:55,580

happens if complex humans came here or

484

00:25:02,399 --> 00:24:58,309

other complex life maybe how do you

485

00:25:07,720 --> 00:25:02,409

think people would react to that yeah

486

00:25:12,909 --> 00:25:07,730

it's really interesting and when we

487

00:25:16,599 --> 00:25:12,919

think about the human history would be a

488

00:25:22,180 --> 00:25:16,609

big surprise when people recognize that

489

00:25:24,810 --> 00:25:22,190

the US is a Sufi rather than friend and

490

00:25:27,460 --> 00:25:24,820

also there would be a big surprise when

491

00:25:29,950 --> 00:25:27,470

people found that earth is orbiting

492

00:25:37,239 --> 00:25:29,960

around a lot of the science orbiting

493

00:25:42,009 --> 00:25:37,249

around us so yeah I think that kind of

494

00:25:47,529 --> 00:25:42,019

new findings we completely change our

495

00:25:51,039 --> 00:25:47,539

view of the world whoa universe and it's

496

00:25:53,799 --> 00:25:51,049

not directly change our daily life

497

00:25:56,680 --> 00:25:53,809

because we always need to wake up in the

498

00:25:59,680 --> 00:25:56,690

morning and go to all streets

499

00:26:04,389 --> 00:25:59,690

it doesn't change but eventually such

500

00:26:07,619 --> 00:26:04,399

kind of big difference in our

501
00:26:13,710 --> 00:26:07,629
understanding of the universe would

502
00:26:21,249 --> 00:26:13,720
change our culture I think and I

503
00:26:25,649 --> 00:26:21,259
actually don't think complex track like

504
00:26:31,210 --> 00:26:25,659
like a human came from other press right

505
00:26:35,519 --> 00:26:31,220
rods because we have the fossil record

506
00:26:39,460 --> 00:26:35,529
of how life evolved on this planet but

507
00:26:43,239 --> 00:26:39,470
it's possible that some organic

508
00:26:48,539 --> 00:26:43,249
materials or even the primitive the

509
00:26:52,359 --> 00:26:48,549
microbes came from Mars or elsewhere or

510
00:26:56,229 --> 00:26:52,369
even the such kind of ragged emerged or

511
00:26:57,779 --> 00:26:56,239
us what's transported to other press

512
00:26:59,960 --> 00:26:57,789
because we

513
00:27:03,659 --> 00:26:59,970

really know that the materials are

514

00:27:07,099 --> 00:27:03,669

transported between the Earth and Mars

515

00:27:11,639 --> 00:27:07,109

we have huge sample of Martian

516

00:27:15,690 --> 00:27:11,649

meteorites or athletes possibility even

517

00:27:19,109 --> 00:27:15,700

with that kinds only the transport of

518

00:27:22,739 --> 00:27:19,119

microbes that will give us a big

519

00:27:25,859 --> 00:27:22,749

surprise about how life over the world

520

00:27:27,690 --> 00:27:25,869

in DC universe absolutely it's awesome

521

00:27:29,999 --> 00:27:27,700

yeah it's interesting question I've

522

00:27:32,279 --> 00:27:30,009

never seen such impasse is a regular

523

00:27:32,849 --> 00:27:32,289

viewer of our show a big supporter hi

524

00:27:34,529 --> 00:27:32,859

Jim

525

00:27:36,810 --> 00:27:34,539

so it's an interesting question for him

526

00:27:37,769 --> 00:27:36,820

to ask and it's good for us to think

527

00:27:39,359 --> 00:27:37,779

about even though I think you're

528

00:27:41,070 --> 00:27:39,369

probably right it seems like because we

529

00:27:44,249 --> 00:27:41,080

have record that that's probably not

530

00:27:46,200 --> 00:27:44,259

likely but so let's move on to our next

531

00:27:47,190 --> 00:27:46,210

question which also has to do with what

532

00:27:50,669 --> 00:27:47,200

you're just speaking about with things

533

00:27:52,739 --> 00:27:50,679

coming to earth obviously there's been a

534

00:27:56,519 --> 00:27:52,749

consideration argument for some time

535

00:27:59,099 --> 00:27:56,529

about where earth got its water from was

536

00:28:01,499 --> 00:27:59,109

earth water delivered via comets or to

537

00:28:03,899 --> 00:28:01,509

Earth's water start inside the planet

538

00:28:06,839 --> 00:28:03,909

from the minerals that formed us so

539

00:28:09,719 --> 00:28:06,849

Twitter user Michael long at McCoy hi

540

00:28:11,940 --> 00:28:09,729

Michael he wants to know what is the

541

00:28:14,249 --> 00:28:11,950

latest scientific understanding of how

542

00:28:16,259 --> 00:28:14,259

earth goddess water and what

543

00:28:18,060 --> 00:28:16,269

implications does this have for the

544

00:28:21,659 --> 00:28:18,070

abundances of water on terrestrial

545

00:28:24,450 --> 00:28:21,669

planets at rest or exoplanets yeah that

546

00:28:26,940 --> 00:28:24,460

is a really great question and it's

547

00:28:32,700 --> 00:28:26,950

solely related to the list of hawaii's

548

00:28:37,769 --> 00:28:32,710

and the spacecraft to asteroids and okay

549

00:28:41,239 --> 00:28:37,779

in the current understanding the the

550

00:28:46,129 --> 00:28:41,249

water us would have been delivered to

551

00:28:51,210 --> 00:28:46,139

this planet in the early stage of the

552

00:28:54,499 --> 00:28:51,220

planet formation maybe by asteroids

553

00:28:59,399 --> 00:28:54,509

rather than comet we have some evidence

554

00:29:04,739 --> 00:28:59,409

from the isotopes or some elementary

555

00:29:09,330 --> 00:29:04,749

bondas measurement in comments and the

556

00:29:11,070 --> 00:29:09,340

the idea is that the my course the the

557

00:29:15,000 --> 00:29:11,080

asteroids which

558

00:29:19,560 --> 00:29:15,010

contain lots of Baroda chicory exists in

559

00:29:21,720 --> 00:29:19,570

the outer solar system and we believe

560

00:29:25,710 --> 00:29:21,730

that the the original material which

561

00:29:28,740 --> 00:29:25,720

forward in the inner solar system would

562

00:29:31,019 --> 00:29:28,750

have been relatively dry so there was a

563

00:29:33,690 --> 00:29:31,029

mechanism which transported the material

564

00:29:38,210 --> 00:29:33,700

to grow outer solar system to the inner

565

00:29:43,129 --> 00:29:38,220

solar system and some theoretical

566

00:29:45,149 --> 00:29:43,139

modeling suggests that that material was

567

00:29:48,990 --> 00:29:45,159

transported from the outer to inner

568

00:29:52,110 --> 00:29:49,000

forested system in the form of the the

569

00:29:54,419 --> 00:29:52,120

small bodies like asteroids the because

570

00:29:59,870 --> 00:29:54,429

of deformation with Jupiter and some

571

00:30:04,169 --> 00:29:59,880

migration of Jupiter in the re Sora

572

00:30:09,029 --> 00:30:04,179

system and this kind of the prediction

573

00:30:12,600 --> 00:30:09,039

can be at least partially test with the

574

00:30:16,350 --> 00:30:12,610

sopra we returned back from asteroids

575

00:30:18,529 --> 00:30:16,360

with the help to spacecraft because that

576

00:30:22,860 --> 00:30:18,539

asteroid is actually the near-earth

577

00:30:24,870 --> 00:30:22,870

asteroids but there is some reason

578

00:30:29,279 --> 00:30:24,880

to believe that that asteroids the

579

00:30:32,580 --> 00:30:29,289

fragment of larger asteroids exist in

580

00:30:34,350 --> 00:30:32,590

the outer solar system so I believe this

581

00:30:40,100 --> 00:30:34,360

kind of hypothesis can beat estimates

582

00:30:44,149 --> 00:30:40,110

our mission and regarding to the

583

00:30:51,480 --> 00:30:44,159

prediction to the exoplanets water

584

00:30:54,750 --> 00:30:51,490

abundance this the Surrey for the

585

00:30:57,509 --> 00:30:54,760

transportation of water from the outer

586

00:31:01,470 --> 00:30:57,519

solar system to the inner solar system

587

00:31:08,060 --> 00:31:01,480

in the form of asteroids is correct this

588

00:31:12,750 --> 00:31:08,070

means that the the the presence of other

589

00:31:16,430 --> 00:31:12,760

planets such as Jupiter is important to

590

00:31:21,930 --> 00:31:16,440

transport the material to attract

591

00:31:24,780 --> 00:31:21,940

planets so it's hard to predict the

592

00:31:26,850 --> 00:31:24,790

exact body for

593

00:31:28,830 --> 00:31:26,860

each eggs of planets about the world

594

00:31:31,400 --> 00:31:28,840

around us and each other to predict this

595

00:31:35,520 --> 00:31:31,410

frequency of the distribution but I

596

00:31:37,890 --> 00:31:35,530

expect because the presence of or

597

00:31:38,550 --> 00:31:37,900

absence of gas giant in planetary

598

00:31:42,180 --> 00:31:38,560

systems

599

00:31:45,000 --> 00:31:42,190

hurry depends on it each system there

600

00:31:51,440 --> 00:31:45,010

will be huge variation in the water

601
00:31:54,500 --> 00:31:51,450
Amanda's in X or Sora austrack Granite's

602
00:31:58,560 --> 00:31:54,510
having such collaboration is really

603
00:32:02,340 --> 00:31:58,570
interesting for me or other practice

604
00:32:07,640 --> 00:32:02,350
science because we have really huge

605
00:32:13,140 --> 00:32:07,650
diversity of a strike plants and it's

606
00:32:16,920 --> 00:32:13,150
really interesting to understand in

607
00:32:22,560 --> 00:32:16,930
future what kind of condition in terms

608
00:32:27,570 --> 00:32:22,570
of wort abundance it's good to good for

609
00:32:28,620 --> 00:32:27,580
that pride to tip it over I think it

610
00:32:30,390 --> 00:32:28,630
sounds like that's that's a really cool

611
00:32:33,720 --> 00:32:30,400
way that we could then use computer

612
00:32:35,280 --> 00:32:33,730
modeling to maybe predict where are

613
00:32:36,420 --> 00:32:35,290

those exoplanets are that have oceans

614

00:32:40,500 --> 00:32:36,430

which could be a really cool thing to

615

00:32:42,300 --> 00:32:40,510

find I do our next question this one

616

00:32:43,860 --> 00:32:42,310

comes from Twitter from the explainable

617

00:32:46,580 --> 00:32:43,870

z-- which is a science communication

618

00:32:50,340 --> 00:32:46,590

group I'm a member of explainable z--

619

00:32:52,950 --> 00:32:50,350

their question is detection of oxygen

620

00:32:55,710 --> 00:32:52,960

and methane and especially seasonal

621

00:32:58,980 --> 00:32:55,720

change of changes of them would be a

622

00:33:01,260 --> 00:32:58,990

strong bio signature in exoplanets now

623

00:33:03,750 --> 00:33:01,270

that we have found that on Mars or maybe

624

00:33:07,680 --> 00:33:03,760

not but it's been it's been proposed we

625

00:33:11,310 --> 00:33:07,690

found methane on Mars the question is

626

00:33:14,850 --> 00:33:11,320

why is that not a bio signature okay

627

00:33:19,820 --> 00:33:14,860

yeah this is a really great question and

628

00:33:24,680 --> 00:33:19,830

it's true that the scientists argue that

629

00:33:27,450 --> 00:33:24,690

we found the oxygen molecule and

630

00:33:30,650 --> 00:33:27,460

missiles simultaneously owing surprise

631

00:33:34,170 --> 00:33:30,660

atmosphere that would be the signature

632

00:33:34,860 --> 00:33:34,180

biological activity because so two more

633

00:33:37,690 --> 00:33:34,870

kills

634

00:33:42,669 --> 00:33:37,700

cannot coexist

635

00:33:45,580 --> 00:33:42,679

in the plant without like because the

636

00:33:49,539 --> 00:33:45,590

reaction changes the atomic composer and

637

00:33:52,659 --> 00:33:49,549

maybe the oxygen completely oxidize the

638

00:33:57,070 --> 00:33:52,669

metal base and completely reduce oxygen

639

00:34:01,149 --> 00:33:57,080

molecules and the point is that we need

640

00:34:04,570 --> 00:34:01,159

the permanent existence were permanent

641

00:34:08,069 --> 00:34:04,580

coexistence of those two species to say

642

00:34:11,549 --> 00:34:08,079

this is a bio signature and almost the

643

00:34:15,909 --> 00:34:11,559

DJ molecule in the atmosphere is

644

00:34:18,700 --> 00:34:15,919

permanent but this is likely to be a

645

00:34:21,450 --> 00:34:18,710

result of the the photochemistry which

646

00:34:24,250 --> 00:34:21,460

dissociated atmospheric carbon dioxide

647

00:34:29,619 --> 00:34:24,260

dioxide which is the main component of

648

00:34:32,639 --> 00:34:29,629

the atmosphere and there was some

649

00:34:37,299 --> 00:34:32,649

possible detection of methane on Mars

650

00:34:42,119 --> 00:34:37,309

for example by the Curiosity rover and

651
00:34:46,659 --> 00:34:42,129
that methane is not apparent but it's

652
00:34:50,049 --> 00:34:46,669
intermittently emitted from somewhere

653
00:34:53,369 --> 00:34:50,059
possibly you know subsurface and but

654
00:34:56,500 --> 00:34:53,379
after the emission the the message

655
00:35:02,190 --> 00:34:56,510
abundance quickly goes down so which

656
00:35:11,620 --> 00:35:08,160
wall she died species so this means that

657
00:35:15,069 --> 00:35:11,630
the Martian atmosphere has a potential

658
00:35:19,839 --> 00:35:15,079
to return to the equilibrium state we

659
00:35:22,660 --> 00:35:19,849
are missing does not exist and this kind

660
00:35:25,569 --> 00:35:22,670
of relatively tiny amount of the methane

661
00:35:30,069 --> 00:35:25,579
can be released from some subsurface

662
00:35:35,200 --> 00:35:30,079
water rock reaction or the release of

663
00:35:39,940 --> 00:35:35,210

Mesa in some hydrate and so that we can

664

00:35:42,819 --> 00:35:39,950

not say the intermitted coexistence of

665

00:35:47,520 --> 00:35:42,829

ocean water with the methane in Russia

666

00:35:50,770 --> 00:35:47,530

Artemisia is not strong crews for

667

00:35:51,609 --> 00:35:50,780

biological activity on one so the

668

00:35:54,819 --> 00:35:51,619

important

669

00:35:58,870 --> 00:35:54,829

is the the prominent coin is a distance

670

00:36:02,469 --> 00:35:58,880

of two species if the missing is a

671

00:36:07,749 --> 00:36:02,479

permanent with oxygen molecule we need a

672

00:36:10,870 --> 00:36:07,759

huge source of methane and just that is

673

00:36:13,239 --> 00:36:10,880

hard to explain with some biological

674

00:36:15,819 --> 00:36:13,249

activity so it could be a strong

675

00:36:17,949 --> 00:36:15,829

signature of biological activity that is

676

00:36:20,559 --> 00:36:17,959

my answer yeah that's a pretty good

677

00:36:22,179 --> 00:36:20,569

answer - I agree with that I think you

678

00:36:24,729 --> 00:36:22,189

know seeing whiffs of potential methane

679

00:36:27,130 --> 00:36:24,739

is one thing but we need some consistent

680

00:36:27,999 --> 00:36:27,140

methane on Mars it's a good question

681

00:36:29,789 --> 00:36:28,009

though it's important I think for

682

00:36:33,279 --> 00:36:29,799

exoplanets for us to think about

683

00:36:34,689 --> 00:36:33,289

seasonal changes in reduced and oxidized

684

00:36:37,479 --> 00:36:34,699

species that could lead to life

685

00:36:40,569 --> 00:36:37,489

detection our next question comes from

686

00:36:43,779 --> 00:36:40,579

Sagan net user Preetha typo Preetha

687

00:36:45,729 --> 00:36:43,789

wants to know she says he says asteroids

688

00:36:47,469 --> 00:36:45,739

lacks so many characteristics of a

689

00:36:49,779 --> 00:36:47,479

planet that are essential for life

690

00:36:52,140 --> 00:36:49,789

at least as we know it why are they

691

00:36:55,539 --> 00:36:52,150

studied so frequently

692

00:36:58,150 --> 00:36:55,549

so could you clearly beat up yes so it

693

00:37:00,249 --> 00:36:58,160

says asteroids lacked so many things

694

00:37:02,709 --> 00:37:00,259

that a planet has they're essential for

695

00:37:08,049 --> 00:37:02,719

life so why are they studied so

696

00:37:15,130 --> 00:37:08,059

frequently okay um the reason why the

697

00:37:19,059 --> 00:37:15,140

scientists study asteroid is that there

698

00:37:23,439 --> 00:37:19,069

would be a record over the early solar

699

00:37:27,309 --> 00:37:23,449

system have the materials such as rotor

700

00:37:33,880 --> 00:37:27,319

and the organics workers transported

701
00:37:37,419 --> 00:37:33,890
within the Soraa system and other

702
00:37:41,859 --> 00:37:37,429
planets because of some geologic

703
00:37:45,519 --> 00:37:41,869
activity was biological activity in the

704
00:37:49,299 --> 00:37:45,529
case of us the such kind of record who

705
00:37:54,819 --> 00:37:49,309
are a solar system has been already lost

706
00:37:57,880 --> 00:37:54,829
but the pleases still remaining liquid

707
00:38:02,679 --> 00:37:57,890
over r-e so the solar system or asteroid

708
00:38:04,040 --> 00:38:02,689
so that's why scientists we care about

709
00:38:10,880 --> 00:38:04,050
the

710
00:38:12,950 --> 00:38:10,890
me out like that I'm also so I'm kind of

711
00:38:15,500 --> 00:38:12,960
curious what you think I'm currently

712
00:38:18,590 --> 00:38:15,510
reading the novels in the expanse series

713
00:38:22,490 --> 00:38:18,600

from the television show and in the

714

00:38:24,290 --> 00:38:22,500

novel's humans have started colonizing a

715

00:38:25,250 --> 00:38:24,300

lot of the asteroid bodies in our solar

716

00:38:27,470 --> 00:38:25,260

system

717

00:38:31,100 --> 00:38:27,480

they've colonized series and turned it

718

00:38:33,170 --> 00:38:31,110

into a base they colonized many moons do

719

00:38:36,170 --> 00:38:33,180

you think humans in the future will

720

00:38:39,290 --> 00:38:36,180

easily be able to go out and to to build

721

00:38:42,620 --> 00:38:39,300

colonies inside of asteroids yeah

722

00:38:47,980 --> 00:38:42,630

actually I reckon science fiction's and

723

00:38:54,320 --> 00:38:47,990

I believe that in future people can live

724

00:38:59,030 --> 00:38:54,330

within the asteroids because some types

725

00:39:05,750 --> 00:38:59,040

of asteroids have some rota ice-fishing

726

00:39:10,310 --> 00:39:05,760

it and even some borax materials exist

727

00:39:15,260 --> 00:39:10,320

in the asteroids even presently a solar

728

00:39:21,530 --> 00:39:15,270

system and those kind of resource can be

729

00:39:27,890 --> 00:39:21,540

used to a human to live in the space and

730

00:39:31,100 --> 00:39:27,900

also the inside asteroids it's good to

731

00:39:34,960 --> 00:39:31,110

protect our service from the a strong

732

00:39:40,670 --> 00:39:34,970

surah in radiation Essaouira wind

733

00:39:44,870 --> 00:39:40,680

radiation so I think such kind of story

734

00:39:47,600 --> 00:39:44,880

is not linear strange science fiction

735

00:39:51,470 --> 00:39:47,610

but it's possible prediction for our

736

00:39:56,750 --> 00:39:51,480

future development

737

00:39:58,280 --> 00:39:56,760

I think live in the future so bad so our

738

00:40:01,010 --> 00:39:58,290

next question comes again from the

739

00:40:03,620 --> 00:40:01,020

explainable is Twitter account this one

740

00:40:06,380 --> 00:40:03,630

asks the Martian moons exploration probe

741

00:40:09,530 --> 00:40:06,390

that MMX is supposed to bring back

742

00:40:11,030 --> 00:40:09,540

something around 10 grams of sample or

743

00:40:13,440 --> 00:40:11,040

greater than 10 grams of sample from

744

00:40:15,240 --> 00:40:13,450

Phobos the question is

745

00:40:18,030 --> 00:40:15,250

what is the maximum amount that this

746

00:40:20,130 --> 00:40:18,040

could return if everything works out and

747

00:40:24,770 --> 00:40:20,140

also are there any planetary protection

748

00:40:31,170 --> 00:40:28,890

could you be the second harm yeah so

749

00:40:32,910 --> 00:40:31,180

that the first part was what is the

750

00:40:36,480 --> 00:40:32,920

maximum amount of sample that could come

751
00:40:40,440 --> 00:40:36,490
back with MMX and the second part is is

752
00:40:42,839 --> 00:40:40,450
there any planetary protection concept

753
00:40:44,880 --> 00:40:42,849
protocols in place to make sure these

754
00:40:50,370 --> 00:40:44,890
samples don't contaminate us or we don't

755
00:40:54,720 --> 00:40:50,380
contaminate them okay okay

756
00:40:59,130 --> 00:40:54,730
for the the amount we bring back as you

757
00:41:04,349 --> 00:40:59,140
said it's estimated to be about 10 gram

758
00:41:10,339 --> 00:41:04,359
and no scientists working hard to

759
00:41:13,260 --> 00:41:10,349
actually decide in the capacity to

760
00:41:17,270 --> 00:41:13,270
return the sample back but it's upon

761
00:41:20,790 --> 00:41:17,280
Christmas 10 gram and regarding to the

762
00:41:24,500 --> 00:41:20,800
second question of course we care much

763
00:41:28,020 --> 00:41:24,510

about the primary protection sinks and

764

00:41:31,920 --> 00:41:28,030

example so some of my colleagues

765

00:41:35,849 --> 00:41:31,930

estimated if we have a potential to

766

00:41:39,900 --> 00:41:35,859

bring back living life from that sub

767

00:41:46,050 --> 00:41:39,910

room Phobos and fortunately were

768

00:41:49,530 --> 00:41:46,060

unfortunately from that s mission the we

769

00:41:54,240 --> 00:41:49,540

would not bring back any living cell

770

00:41:58,740 --> 00:41:54,250

from foremost because the Rosi process

771

00:42:04,710 --> 00:41:58,750

which delivers materials from a surface

772

00:42:09,870 --> 00:42:04,720

to force or the living life will be will

773

00:42:14,750 --> 00:42:09,880

be dead because of the shock process and

774

00:42:19,500 --> 00:42:14,760

also the irradiation cosmic ray

775

00:42:21,980 --> 00:42:19,510

but these people here really much about

776

00:42:25,530 --> 00:42:21,990

the planetary protection stuff yes

777

00:42:26,970 --> 00:42:25,540

awesome man so maybe no Fabozzi and

778

00:42:29,730 --> 00:42:26,980

alien invaders yet

779

00:42:32,280 --> 00:42:29,740

but you never know so our next question

780

00:42:34,680 --> 00:42:32,290

comes from my dear friend and co-host

781

00:42:38,520 --> 00:42:34,690

and fellow researcher from the Marvel

782

00:42:42,900 --> 00:42:38,530

space Sanjoy some on Twitter at Sandra

783

00:42:44,310 --> 00:42:42,910

Marcel and Sandra asks so hero what

784

00:42:54,540 --> 00:42:44,320

would what would be your dream

785

00:42:59,069 --> 00:42:54,550

Hayabusa 3 mission yeah okay we could

786

00:43:06,120 --> 00:42:59,079

have hired three mission I directed

787

00:43:12,930 --> 00:43:06,130

bring back sample where we potentially

788

00:43:18,060 --> 00:43:12,940

have some life builders and my favorite

789

00:43:23,690 --> 00:43:18,070

target would be Europa orbiting Jupiter

790

00:43:29,310 --> 00:43:23,700

the Europa has subsurface ocean and

791

00:43:32,280 --> 00:43:29,320

scientists are discussing the the

792

00:43:35,250 --> 00:43:32,290

chemical operation within the subsurface

793

00:43:39,660 --> 00:43:35,260

ocean a rope and also even the the

794

00:43:42,809 --> 00:43:39,670

possible emergence of life on it so it

795

00:43:48,410 --> 00:43:42,819

would be really great if we can its

796

00:43:52,109 --> 00:43:48,420

sample back from the Europa even the

797

00:43:54,870 --> 00:43:52,119

sample return from the service would be

798

00:43:57,900 --> 00:43:54,880

really useful because the it's icy

799

00:44:01,800 --> 00:43:57,910

sockets would be covered by the material

800

00:44:04,680 --> 00:44:01,810

which was emitted the subsurface ocean

801
00:44:05,640 --> 00:44:04,690
that would be my dream awesome

802
00:44:08,220 --> 00:44:05,650
yeah that sounds like a really cool

803
00:44:11,640 --> 00:44:08,230
mission I think it fits with our next

804
00:44:13,980 --> 00:44:11,650
question from user Joe lid who my

805
00:44:16,079 --> 00:44:13,990
producer and my teleprompter runner here

806
00:44:17,730 --> 00:44:16,089
I understand is very active right now on

807
00:44:20,490 --> 00:44:17,740
the Facebook page watching the show so

808
00:44:22,859 --> 00:44:20,500
hi Joe thank you for that Joe wants to

809
00:44:25,800 --> 00:44:22,869
know which moon you think has the better

810
00:44:31,380 --> 00:44:25,810
potential for hosting life in sodas or

811
00:44:35,190 --> 00:44:31,390
Europa okay um yeah totally related to

812
00:44:35,700 --> 00:44:35,200
who I excused Europa as a target of hive

813
00:44:39,009 --> 00:44:35,710

cells

814

00:44:48,259 --> 00:44:43,190

there are several different aspects to

815

00:44:50,930 --> 00:44:48,269

compare two moons for example in Thomas

816

00:44:54,680 --> 00:44:50,940

the the physical aspect of the

817

00:44:58,539 --> 00:44:54,690

subsurface ocean the aspects of the

818

00:45:01,219 --> 00:44:58,549

chemical compulsion which may or the

819

00:45:04,690 --> 00:45:01,229

chemical evolution of the organic

820

00:45:09,949 --> 00:45:04,700

materials which could of life and

821

00:45:13,039 --> 00:45:09,959

because I'm basically the physicists the

822

00:45:17,440 --> 00:45:13,049

my answer is based on the the physics of

823

00:45:21,650 --> 00:45:17,450

the subsurface ocean the we know that

824

00:45:25,609 --> 00:45:21,660

both of those moons could have a

825

00:45:28,449 --> 00:45:25,619

subsurface ocean but the L robots have

826

00:45:32,059 --> 00:45:28,459

such OSHA will be much more of

827

00:45:34,699 --> 00:45:32,069

long-living it's it would be a permanent

828

00:45:36,410 --> 00:45:34,709

because because of its size and also

829

00:45:42,219 --> 00:45:36,420

they're tied our interaction with

830

00:45:45,589 --> 00:45:42,229

Jupiter and in terms of the

831

00:45:48,969 --> 00:45:45,599

sustainability of a subsurface ocean we

832

00:45:54,620 --> 00:45:48,979

have some clue that the subsurface ocean

833

00:45:57,199 --> 00:45:54,630

still exists inside us but because

834

00:46:00,229 --> 00:45:57,209

Enceladus is much much smaller compared

835

00:46:04,989 --> 00:46:00,239

with Europe and also the the energy

836

00:46:08,650 --> 00:46:04,999

source would be much more limited that

837

00:46:15,789 --> 00:46:08,660

present-day subsurface ocean on

838

00:46:22,509 --> 00:46:15,799

Enceladus might be some intermittent

839

00:46:26,089 --> 00:46:22,519

state and in the past that such osa

840

00:46:29,089 --> 00:46:26,099

might be freezing but some recent

841

00:46:32,809 --> 00:46:29,099

interaction with other satellites in

842

00:46:36,840 --> 00:46:32,819

terms of tidal interaction create the

843

00:46:38,559 --> 00:46:36,850

recent subsurface ocean in that case

844

00:46:43,160 --> 00:46:38,569

[Music]

845

00:46:45,380 --> 00:46:43,170

incidence would not have enough time to

846

00:46:48,769 --> 00:46:45,390

develop life

847

00:46:50,549 --> 00:46:48,779

so considering this kind of point I

848

00:46:56,339 --> 00:46:50,559

prefer the

849

00:47:02,890 --> 00:46:56,349

I-dopa as a potential satellite which

850

00:47:05,559 --> 00:47:02,900

has life in it but I'm also a huge fan

851
00:47:07,480 --> 00:47:05,569
of your rep of myself and so I kind of I

852
00:47:09,880 --> 00:47:07,490
kind of favor Europa but that that takes

853
00:47:13,480 --> 00:47:09,890
us to our next question actually from

854
00:47:16,150 --> 00:47:13,490
our viewer Mary Ann hi Mary Ann from

855
00:47:18,970 --> 00:47:16,160
Facebook Mary Ann says but speaking of

856
00:47:21,190 --> 00:47:18,980
organics we do know from Cassini that

857
00:47:23,970 --> 00:47:21,200
Cassini has already detected organic

858
00:47:26,230 --> 00:47:23,980
materials in enceladus's geyser plumes

859
00:47:27,460 --> 00:47:26,240
so should that be a priority for future

860
00:47:34,329 --> 00:47:27,470
research given the evidence they're

861
00:47:38,170 --> 00:47:34,339
already the the finding of some organic

862
00:47:41,200 --> 00:47:38,180
compounds here the incident sky that was

863
00:47:46,720 --> 00:47:41,210

really really exciting and it's really

864

00:47:50,700 --> 00:47:46,730

nice to investigate for the how much the

865

00:47:58,329 --> 00:47:50,710

chemical revolution proceed in the

866

00:48:02,980 --> 00:47:58,339

cerrados and we may not find the life in

867

00:48:05,309 --> 00:48:02,990

the geyser with a future mission because

868

00:48:10,299 --> 00:48:05,319

we don't know if the chemical revolution

869

00:48:17,109 --> 00:48:10,309

reached to the state where the life can

870

00:48:21,609 --> 00:48:17,119

emerge but yeah even with its really

871

00:48:26,010 --> 00:48:21,619

nice to investigate how much chemical

872

00:48:29,230 --> 00:48:26,020

evolution proceed in cerrados

873

00:48:36,789 --> 00:48:29,240

because we don't really know the process

874

00:48:40,019 --> 00:48:36,799

which fought like even our us so it's

875

00:48:44,019 --> 00:48:40,029

really great to test the process of the

876

00:48:48,370 --> 00:48:44,029

no biologic

877

00:48:53,099 --> 00:48:48,380

chemical evolution MOBOTIX materials in

878

00:48:57,309 --> 00:48:53,109

terms of that it's really nice to see

879

00:49:01,809 --> 00:48:57,319

the Theravada compounds in incidence

880

00:49:03,600 --> 00:49:01,819

guys even though we may end up with non

881

00:49:05,910 --> 00:49:03,610

detection it's actually

882

00:49:08,180 --> 00:49:05,920

same for Europa we might end up with a

883

00:49:11,250 --> 00:49:08,190

non detection but non the detections

884

00:49:14,300 --> 00:49:11,260

would be good good to constrain the

885

00:49:16,680 --> 00:49:14,310

requirements for life to a much so

886

00:49:18,660 --> 00:49:16,690

absolutely yeah I think sometimes we get

887

00:49:19,980 --> 00:49:18,670

so giddy about life being possible in

888

00:49:21,570 --> 00:49:19,990

our own solar system beyond Earth we

889

00:49:24,420 --> 00:49:21,580

forget that that we might be the only

890

00:49:25,770 --> 00:49:24,430

life in our solar system I'm gonna jump

891

00:49:29,880 --> 00:49:25,780

to our next question here it's from

892

00:49:32,520 --> 00:49:29,890

Twitter user at rendering reality this

893

00:49:33,870 --> 00:49:32,530

user wants to know can you explain how

894

00:49:36,240 --> 00:49:33,880

the formation of the solar system

895

00:49:38,960 --> 00:49:36,250

impacted the distribution of water and

896

00:49:41,280 --> 00:49:38,970

ice and how does that connect to water

897

00:49:45,650 --> 00:49:41,290

on the surface of planets versus

898

00:49:53,010 --> 00:49:49,980

yeah the scientists including me are

899

00:49:56,700 --> 00:49:53,020

trying to understand the formation of

900

00:49:59,390 --> 00:49:56,710

the solar system especially a screen

901
00:50:07,230 --> 00:49:59,400
it's Christian in terms of the Vorta

902
00:50:10,710 --> 00:50:07,240
abundance and actually the in terms of

903
00:50:13,800 --> 00:50:10,720
theory there are a lot of possible

904
00:50:18,510 --> 00:50:13,810
processes which can deliver water to us

905
00:50:24,780 --> 00:50:18,520
and sometimes in our modeling we end up

906
00:50:27,680 --> 00:50:24,790
with too much water on earth so people

907
00:50:32,670 --> 00:50:27,690
including me are trying to explain why

908
00:50:39,960 --> 00:50:32,680
this earth has this tiny amount of water

909
00:50:43,200 --> 00:50:39,970
in Thomas weeks bark compulsion so so

910
00:50:46,950 --> 00:50:43,210
yeah the answer is we don't fully

911
00:50:51,030 --> 00:50:46,960
understand the religion of the water and

912
00:50:54,120 --> 00:50:51,040
how it was distributed in our solar

913
00:50:57,930 --> 00:50:54,130

system but we have some Surry and which

914

00:51:03,750 --> 00:50:57,940

could be tested in future missions

915

00:51:06,270 --> 00:51:03,760

including helps a 200mm X awesome you

916

00:51:07,470 --> 00:51:06,280

know I agree entirely so so I do want

917

00:51:09,210 --> 00:51:07,480

jump this before our next questions we

918

00:51:11,580 --> 00:51:09,220

have a few more questions ever I get to

919

00:51:13,230 --> 00:51:11,590

before we can close up this episode our

920

00:51:16,250 --> 00:51:13,240

next question comes from a Facebook user

921

00:51:17,990 --> 00:51:16,260

named Connor Cody

922

00:51:20,750 --> 00:51:18,000

so first off this question involves

923

00:51:22,280 --> 00:51:20,760

what's called the Fermi paradox that

924

00:51:25,820 --> 00:51:22,290

many of us have argued it's not actually

925

00:51:28,670 --> 00:51:25,830

a paradox this is the question posed by

926
00:51:31,810 --> 00:51:28,680
Enrico Fermi when he was discussing with

927
00:51:34,640 --> 00:51:31,820
some friends about the potential for

928
00:51:37,130 --> 00:51:34,650
faster than light travel and whether or

929
00:51:39,440 --> 00:51:37,140
not that could actually happen and so

930
00:51:42,050 --> 00:51:39,450
the idea was you know if after the my

931
00:51:43,880 --> 00:51:42,060
travel is possible and there are aliens

932
00:51:46,340 --> 00:51:43,890
out there then where are they was

933
00:51:48,140 --> 00:51:46,350
Fermi's question and that's led a lot of

934
00:51:50,599 --> 00:51:48,150
people to propose this idea they call

935
00:51:52,220 --> 00:51:50,609
the Fermi paradox which is that if there

936
00:51:55,250 --> 00:51:52,230
is abundant alien life out there in the

937
00:51:57,200 --> 00:51:55,260
universe why haven't we found it again

938
00:51:58,849 --> 00:51:57,210

that's not really a paradox in and of

939

00:52:01,820 --> 00:51:58,859

itself because there are many potential

940

00:52:04,280 --> 00:52:01,830

solutions but Connor on Facebook here oh

941

00:52:08,650 --> 00:52:04,290

he wants to know what your thoughts are

942

00:52:13,040 --> 00:52:08,660

about this idea called the Fermi paradox

943

00:52:22,130 --> 00:52:13,050

ok the Christian would be why any alien

944

00:52:23,900 --> 00:52:22,140

life never access to us at least in the

945

00:52:26,150 --> 00:52:23,910

extent we decode is that the question

946

00:52:28,400 --> 00:52:26,160

yeah the question is you know what do

947

00:52:31,160 --> 00:52:28,410

you think about this idea of the yeah

948

00:52:36,170 --> 00:52:31,170

why we haven't met aliens yet yeah I

949

00:52:36,560 --> 00:52:36,180

think of course I don't know the exact

950

00:52:42,440 --> 00:52:36,570

term

951

00:52:51,080 --> 00:52:42,450

this is a huge question but the I like

952

00:52:55,670 --> 00:52:51,090

the idea that the the many life in the

953

00:53:00,590 --> 00:52:55,680

solar system in the universe but in many

954

00:53:04,510 --> 00:53:00,600

cases those like states in the form of

955

00:53:08,270 --> 00:53:04,520

the microbes like a single-cell life

956

00:53:15,130 --> 00:53:08,280

actually when we think about the history

957

00:53:19,640 --> 00:53:15,140

of life in our earth the for the almost

958

00:53:25,310 --> 00:53:19,650

entire history the hosts dryer was just

959

00:53:27,410 --> 00:53:25,320

a microbes so by some reason disgust

960

00:53:29,960 --> 00:53:27,420

develops much more complex rival

961

00:53:38,370 --> 00:53:29,970

including ourselves but

962

00:53:42,259 --> 00:53:38,380

it's dico it's possible that life beyond

963

00:53:48,109 --> 00:53:42,269

us stay in the form of the primitive

964

00:53:50,849 --> 00:53:48,119

microbes that would be my answer

965

00:53:52,859 --> 00:53:50,859

okay yeah I like that too I mean we've

966

00:53:54,480 --> 00:53:52,869

been some microbial in our history and

967

00:53:55,799 --> 00:53:54,490

there's so many other potential things

968

00:53:58,109 --> 00:53:55,809

that could be happening out there in the

969

00:53:59,549 --> 00:53:58,119

cosmos and maybe we are the first to the

970

00:54:01,829 --> 00:53:59,559

game you know if we're not alert and so

971

00:54:03,660 --> 00:54:01,839

there's a lot out there I I do like the

972

00:54:05,579 --> 00:54:03,670

the arthur c clarke quote though that

973

00:54:06,870 --> 00:54:05,589

sometimes i think we're alone in the

974

00:54:08,670 --> 00:54:06,880

universe and sometimes I think for

975

00:54:11,609 --> 00:54:08,680

Naughton and either way it's kind of

976
00:54:14,279 --> 00:54:11,619
staggering right so our next question

977
00:54:17,190 --> 00:54:14,289
comes from a second net user and a dear

978
00:54:19,829 --> 00:54:17,200
friend of the show Kashi SH who asks if

979
00:54:22,829 --> 00:54:19,839
we are successful in finding life on an

980
00:54:27,059 --> 00:54:22,839
exoplanet Sunday what would be the next

981
00:54:32,940 --> 00:54:27,069
step do you think yeah it's a great

982
00:54:37,499 --> 00:54:32,950
question question I think yeah some in

983
00:54:44,420 --> 00:54:37,509
some day we may find the evidence of

984
00:54:48,990 --> 00:54:44,430
life on XPrize I even find the evidence

985
00:54:53,059 --> 00:54:49,000
like beyond us within the solar system

986
00:54:57,470 --> 00:54:53,069
that is really interesting and then

987
00:55:02,519 --> 00:54:57,480
after that I would like to understand

988
00:55:06,450 --> 00:55:02,529

how those life is related to this life

989

00:55:11,990 --> 00:55:06,460

on our earth in terms of the the

990

00:55:19,910 --> 00:55:12,000

connection like the transport of

991

00:55:23,130 --> 00:55:19,920

primitive life among different planets

992

00:55:29,009 --> 00:55:23,140

also I directed know the connection

993

00:55:32,210 --> 00:55:29,019

between different lives in terms of the

994

00:55:35,730 --> 00:55:32,220

the the process I mean the chemical

995

00:55:40,799 --> 00:55:35,740

evolution which ended up with the

996

00:55:42,839 --> 00:55:40,809

emergence of life so I think yeah to

997

00:55:47,459 --> 00:55:42,849

understand the origin of life

998

00:55:48,779 --> 00:55:47,469

on this US would be much more difficult

999

00:55:54,439 --> 00:55:48,789

question

1000

00:55:58,789 --> 00:55:54,449

compared to finding life in Universal I

1001

00:56:01,669 --> 00:55:58,799

guess faster we found life in the

1002

00:56:04,890 --> 00:56:01,679

universe beyond the brass and then we

1003

00:56:10,799 --> 00:56:04,900

probably go back to the question of is

1004

00:56:12,900 --> 00:56:10,809

life on our planet that's awesome so I

1005

00:56:15,239 --> 00:56:12,910

I'm sorry we only have time for one more

1006

00:56:16,739 --> 00:56:15,249

question to all of our audience out

1007

00:56:18,449 --> 00:56:16,749

there who have so many awesome questions

1008

00:56:20,489 --> 00:56:18,459

thank you so much

1009

00:56:23,309 --> 00:56:20,499

the last question is from second net

1010

00:56:25,109 --> 00:56:23,319

user Thomas Windsor and Thomas just

1011

00:56:28,289 --> 00:56:25,119

wants to know we've discussed a bunch

1012

00:56:32,519 --> 00:56:28,299

during this episode about Hayabusa 2 and

1013

00:56:34,289 --> 00:56:32,529

about MMX and so Thomas just wants to

1014

00:56:38,009 --> 00:56:34,299

know if you wouldn't mind giving us a

1015

00:56:39,539 --> 00:56:38,019

little status update on both missions on

1016

00:56:42,239 --> 00:56:39,549

the achievements and current you know

1017

00:56:45,469 --> 00:56:42,249

work going on hi boo so - and on where

1018

00:56:52,890 --> 00:56:45,479

the MMX mission is right now in planning

1019

00:56:56,549 --> 00:56:52,900

ok us about diversity succeed to get a

1020

00:57:03,929 --> 00:56:56,559

sample from oxidants now it's in the way

1021

00:57:08,429 --> 00:57:03,939

to come back to earth and originally we

1022

00:57:11,339 --> 00:57:08,439

thought that the target asteroid is a

1023

00:57:14,969 --> 00:57:11,349

so-called she type asteroid which is

1024

00:57:18,269 --> 00:57:14,979

related to the meteorites called

1025

00:57:23,089 --> 00:57:18,279

carbonaceous chondrites which contain

1026

00:57:29,239 --> 00:57:23,099

dots of rotting organic molecules but

1027

00:57:34,529 --> 00:57:29,249

even with the remote sensing around

1028

00:57:41,249 --> 00:57:34,539

absolute we found lots of unexpected

1029

00:57:47,599 --> 00:57:41,259

things such the really dark color of the

1030

00:57:50,359 --> 00:57:47,609

asteroid legal so from the harvest

1031

00:57:54,479 --> 00:57:50,369

missions we already found lots of

1032

00:57:56,760 --> 00:57:54,489

interesting unexpected result which we

1033

00:58:00,240 --> 00:57:56,770

need to explain in

1034

00:58:06,090 --> 00:58:00,250

and then the sample will come back to us

1035

00:58:10,290 --> 00:58:06,100

in the end of this year so I believe we

1036

00:58:16,100 --> 00:58:10,300

get much more expected result from that

1037

00:58:19,470 --> 00:58:16,110

sample and about the MMX recently MMX

1038

00:58:23,250 --> 00:58:19,480

status changed from the so called

1039

00:58:31,310 --> 00:58:23,260

the pre project to the project phase so

1040

00:58:37,170 --> 00:58:33,770

spacecraft

1041

00:58:39,600 --> 00:58:37,180

dotted status awesome thank you so much

1042

00:58:41,790 --> 00:58:39,610

I highly recommend for our viewers to

1043

00:58:44,190 --> 00:58:41,800

check out your work in modeling these

1044

00:58:46,230 --> 00:58:44,200

proto planetary environments the

1045

00:58:48,510 --> 00:58:46,240

evolution formation of worlds in our

1046

00:58:50,460 --> 00:58:48,520

solar system and beyond to keep an eye

1047

00:58:53,400 --> 00:58:50,470

out on Hayabusa 2 and MMX and upcoming

1048

00:58:54,930 --> 00:58:53,410

things here oh thank you so much for

1049

00:58:56,460 --> 00:58:54,940

joining us for asking astrobiologists

1050

00:58:58,380 --> 00:58:56,470

it's been a pleasure having you here I

1051

00:59:01,890 --> 00:58:58,390

thank you very much thank you

1052

00:59:03,990 --> 00:59:01,900

and then for our audience at home one

1053

00:59:06,300 --> 00:59:04,000

call for action for you to share with us

1054

00:59:09,390 --> 00:59:06,310

what you think for ask to ask you as the

1055

00:59:12,000 --> 00:59:09,400

astrobiologists what do you think of the

1056

00:59:13,290 --> 00:59:12,010

Martian moons Phobos and Deimos and what

1057

00:59:15,840 --> 00:59:13,300

do they have in store for us

1058

00:59:19,200 --> 00:59:15,850

when MMX brings that sample back what we

1059

00:59:20,940 --> 00:59:19,210

find we find ancient Martian life hard

1060

00:59:22,620 --> 00:59:20,950

to say right why don't you go out on

1061

00:59:25,140 --> 00:59:22,630

Twitter and tell us what you think with

1062

00:59:28,320 --> 00:59:25,150

hashtag ask Astro bio and answer that

1063

00:59:29,990 --> 00:59:28,330

question for us so until next time thank

1064

00:59:32,500 --> 00:59:30,000

you everyone for joining us and remember