
HUBBLE
hangouts
Hubble And Dawn Collaborate To See Ceres
Thursday 11 December 2014 1pm ET, 6pm UT, 7pm CET

1
00:00:10,640 --> 00:00:08,720
hello everybody and welcome to this

2
00:00:11,749 --> 00:00:10,650
week's Hubbell hangout my name is Tony

3
00:00:13,910 --> 00:00:11,759
Darnell I work at the Space Telescope

4
00:00:16,400 --> 00:00:13,920
Science Institute and this week we've

5
00:00:17,900 --> 00:00:16,410
got another awesome hangout plan for you

6
00:00:20,000 --> 00:00:17,910
what else would we have we always have

7
00:00:21,620 --> 00:00:20,010
awesome hangouts this week we're going

8
00:00:25,310 --> 00:00:21,630
to be talking we have members of the of

9
00:00:26,990 --> 00:00:25,320
NASA's Dawn mission a fatal on hand as

10
00:00:30,019 --> 00:00:27,000
well as the Hubble Space Telescope to

11
00:00:33,200 --> 00:00:30,029
talk about minor planets and asteroids

12
00:00:35,030 --> 00:00:33,210
in particular we've got the NASA Dawn

13
00:00:38,209 --> 00:00:35,040

mission is currently on route to reach

14
00:00:39,590 --> 00:00:38,219
the Minor Planet series early next year

15
00:00:41,420 --> 00:00:39,600
and we're going to get an update about

16
00:00:44,000 --> 00:00:41,430
what's going on some of the science

17
00:00:47,299 --> 00:00:44,010
goals that the team hope to learn as

18
00:00:49,910 --> 00:00:47,309
well as how Hubble was a played a role

19
00:00:52,040 --> 00:00:49,920
in some of these observations as well as

20
00:00:54,709 --> 00:00:52,050
so and some of the science that they're

21
00:00:58,250 --> 00:00:54,719
hoping to get done from this mission

22
00:01:00,619 --> 00:00:58,260
about before I get to the introductions

23
00:01:02,810 --> 00:01:00,629
I want to remind you that we on the

24
00:01:05,990 --> 00:01:02,820
event page of this of this event on

25
00:01:09,620 --> 00:01:06,000
Google+ we have links to Jason Keller

26
00:01:11,840 --> 00:01:09,630
eyes academic minute we would devote

27
00:01:13,310 --> 00:01:11,850
incluso Zahn on Friday we hope you'll

28
00:01:16,010 --> 00:01:13,320
take some time out to click on the link

29
00:01:17,749 --> 00:01:16,020
and if you liked his academic minute he

30
00:01:20,480 --> 00:01:17,759
is up for a listeners Choice Award and

31
00:01:22,580 --> 00:01:20,490
he's the subject of his academic minute

32
00:01:24,109 --> 00:01:22,590
was exploring exoplanets so I hope

33
00:01:25,820 --> 00:01:24,119
you'll take a minute and go there and

34
00:01:28,609 --> 00:01:25,830
vote it would be would be a great show

35
00:01:31,100 --> 00:01:28,619
of support for both the Institute Jason

36
00:01:36,730 --> 00:01:31,110
Kelly and JWST so please do that and

37
00:01:39,410 --> 00:01:36,740
Keller is a really nice guy too so guy

38
00:01:43,100 --> 00:01:39,420

yeah I definitely recommend voting for

39
00:01:46,370 --> 00:01:43,110
him right okay so with me today to

40
00:01:48,469 --> 00:01:46,380
discuss all this fun stuff is dr. John

41
00:01:50,300 --> 00:01:48,479
yang Lee he's been with many he's been

42
00:01:52,219 --> 00:01:50,310
in many hangouts with us he's talked to

43
00:01:54,550 --> 00:01:52,229
us about comets and today he's here to

44
00:01:58,039 --> 00:01:54,560
talk about minor planets hi John yang

45
00:02:02,389 --> 00:01:58,049
also with us is is max Mutchler he is

46
00:02:04,670 --> 00:02:02,399
our Hubble data extraordinaire and he

47
00:02:06,139 --> 00:02:04,680
handles all the Hubble data but my

48
00:02:08,839 --> 00:02:06,149
colleague at the Space Telescope Science

49
00:02:11,089 --> 00:02:08,849
Institute where they are enjoying lots

50
00:02:13,940 --> 00:02:11,099
of snow and you can see it in the

51
00:02:18,710 --> 00:02:13,950
background hi max and also

52
00:02:20,809 --> 00:02:18,720
Carrie beam from the from the NASA dawn

53
00:02:23,000 --> 00:02:20,819
mission she's at planetary Kari hi Kari

54
00:02:23,510 --> 00:02:23,010
and welcome to our hangout before we get

55
00:02:26,449 --> 00:02:23,520
started

56
00:02:27,949 --> 00:02:26,459
Scott yes can you tell everybody how

57
00:02:31,490 --> 00:02:27,959
they can interact with us you're driving

58
00:02:34,790 --> 00:02:31,500
the internet on assignment I'm okay I'm

59
00:02:37,640 --> 00:02:34,800
driving the Internet so yeah we are here

60
00:02:40,610 --> 00:02:37,650
live at NASA's Jet Propulsion Laboratory

61
00:02:42,320 --> 00:02:40,620
if you want to interact with us you can

62
00:02:44,780 --> 00:02:42,330
do so on Twitter using the hashtag

63
00:02:47,510 --> 00:02:44,790

Hubbell Hangouts you can also leave

64
00:02:49,580 --> 00:02:47,520
comments on the Google+ event page we

65
00:02:51,770 --> 00:02:49,590
will be checking those there using the

66
00:02:54,199 --> 00:02:51,780
Q&A app which is available on Google+

67
00:02:55,670 --> 00:02:54,209
and YouTube so on the bottom left-hand

68
00:02:57,920 --> 00:02:55,680
side as you're watching this no matter

69
00:02:59,660 --> 00:02:57,930
where it's at where it's embedded you'll

70
00:03:02,030 --> 00:02:59,670
be able to pop open and you can ask

71
00:03:05,780 --> 00:03:02,040
those questions and will allow us to

72
00:03:08,390 --> 00:03:05,790
answer them on air and then also there

73
00:03:10,699 --> 00:03:08,400
are the comment sections on YouTube so

74
00:03:12,620 --> 00:03:10,709
we'll be monitoring all of those because

75
00:03:15,350 --> 00:03:12,630
we love being able to answer your

76
00:03:18,440 --> 00:03:15,360
questions that are relevant to the topic

77
00:03:21,350 --> 00:03:18,450
oh you only want relevant questions now

78
00:03:23,180 --> 00:03:21,360
now relevant questions but if you have

79
00:03:25,550 --> 00:03:23,190
ideas for future hangouts please let us

80
00:03:28,759 --> 00:03:25,560
know there too because we love getting

81
00:03:30,229 --> 00:03:28,769
new ideas for future hangouts and we

82
00:03:31,910 --> 00:03:30,239
also are remiss when we we've always

83
00:03:32,990 --> 00:03:31,920
forget to do this but please if you want

84
00:03:36,110 --> 00:03:33,000
to learn more about these Hubble

85
00:03:38,990 --> 00:03:36,120
hangouts subscribe to our YouTube

86
00:03:40,640 --> 00:03:39,000
channel youtube.com slash hubble site

87
00:03:42,650 --> 00:03:40,650
channel and you will find out all about

88
00:03:43,819 --> 00:03:42,660

these upcoming events every single week

89
00:03:46,130 --> 00:03:43,829
we have them every Thursday although

90
00:03:47,420 --> 00:03:46,140
today we're doing a little bit early so

91
00:03:51,020 --> 00:03:47,430
let's get started

92
00:03:53,630 --> 00:03:51,030
let me start with you Kari can you what

93
00:03:56,420 --> 00:03:53,640
is dawn what's it hoping to do where is

94
00:03:59,590 --> 00:03:56,430
it going and what's its current status

95
00:04:02,030 --> 00:03:59,600
in that order I'm just kidding

96
00:04:05,660 --> 00:04:02,040
to help me out I'm actually going to

97
00:04:08,780 --> 00:04:05,670
call in dawn I have a nice 25 scale

98
00:04:11,870 --> 00:04:08,790
model here and so this is what our

99
00:04:15,770 --> 00:04:11,880
spacecraft looks like and so and I'm

100
00:04:19,250 --> 00:04:15,780
taking it with me by the way so we

101
00:04:22,700 --> 00:04:19,260
launched in 2007 and we flew by Mars in

102
00:04:26,360 --> 00:04:22,710
2009 and then we got to the asteroid

103
00:04:27,680 --> 00:04:26,370
Vesta in 2011 we left in 2012 and

104
00:04:29,450 --> 00:04:27,690
since then we've been cruising on our

105
00:04:32,750 --> 00:04:29,460
way to Ceres and now we are knocking on

106
00:04:34,490 --> 00:04:32,760
Ceres doorsteps and so we are hoping to

107
00:04:36,110 --> 00:04:34,500
use all of the lovely instruments up

108
00:04:38,330 --> 00:04:36,120
here on the top of the spacecraft to

109
00:04:42,170 --> 00:04:38,340
unlock Ceres secret

110
00:04:43,969 --> 00:04:42,180
we will not arrive at Ceres a rifle is

111
00:04:45,800 --> 00:04:43,979
somewhat of a complicated question for

112
00:04:47,990 --> 00:04:45,810
us because we have a ion propulsion

113
00:04:50,120 --> 00:04:48,000

system and so our dates can shift a

114
00:04:52,159 --> 00:04:50,130
little bit and we're a bit more flexible

115
00:04:55,580 --> 00:04:52,169
than normal mission using chemical

116
00:05:02,659 --> 00:04:55,590
propulsion so you got to tell us what

117
00:05:05,000 --> 00:05:02,669
ion drives are now so actually you can

118
00:05:07,040 --> 00:05:05,010
see one of them here we have three of

119
00:05:08,780 --> 00:05:07,050
them on our spacecraft and I mean it's

120
00:05:10,280 --> 00:05:08,790
totally a sci-fi concept if you think of

121
00:05:12,290 --> 00:05:10,290
Thai fighters from Star because it's in

122
00:05:13,400 --> 00:05:12,300
four twin ion engines and we do them

123
00:05:16,520 --> 00:05:13,410
better at one better because we have

124
00:05:18,590 --> 00:05:16,530
three so the and you can aim better than

125
00:05:23,500 --> 00:05:18,600
Tie Fighters do as well we know how

126
00:05:26,990 --> 00:05:23,510
portable Thai fighters are aiming yes so

127
00:05:28,909 --> 00:05:27,000
use these ion propulsion to move us

128
00:05:31,370 --> 00:05:28,919
around the solar system and it's a very

129
00:05:33,529 --> 00:05:31,380
like graceful slow movement you know

130
00:05:35,510 --> 00:05:33,539
chemical propulsion you fly there as

131
00:05:36,620 --> 00:05:35,520
fast as you can you slam on the brakes

132
00:05:38,120 --> 00:05:36,630
whereas this we're just kind of like

133
00:05:40,670 --> 00:05:38,130
slowly dancing through the solar system

134
00:05:42,830 --> 00:05:40,680
matching the speeds of the bodies we're

135
00:05:45,800 --> 00:05:42,840
trying to visit so it's pretty

136
00:05:47,390 --> 00:05:45,810
interesting the kind of difference and

137
00:05:48,740 --> 00:05:47,400
timescales and the way that we operate

138
00:05:53,390 --> 00:05:48,750

the spacecraft compared to other

139
00:05:55,520 --> 00:05:53,400
missions and so using this we actually

140
00:05:59,060 --> 00:05:55,530
start our series sequences on December

141
00:06:01,850 --> 00:05:59,070
26 so just a couple weeks from now

142
00:06:04,580 --> 00:06:01,860
we'll take our first set of optical

143
00:06:06,500 --> 00:06:04,590
navigation photos in the middle of

144
00:06:08,450 --> 00:06:06,510
January and we finally beat Hubble

145
00:06:11,120 --> 00:06:08,460
resolution at the end of January on

146
00:06:14,779 --> 00:06:11,130
January 25th where we will get one point

147
00:06:16,219 --> 00:06:14,789
four times Hubble resolution so we're

148
00:06:19,550 --> 00:06:16,229
looking for it but no one's counting

149
00:06:20,779 --> 00:06:19,560
over here yeah that's it's an important

150
00:06:21,860 --> 00:06:20,789
date we're going to come back to that in

151
00:06:23,690 --> 00:06:21,870
just a minute but right now I'm giving

152
00:06:27,170 --> 00:06:23,700
you I'm showing a quick overview of the

153
00:06:28,909 --> 00:06:27,180
of the the path that Dawn has gone

154
00:06:32,540 --> 00:06:28,919
through since it launched in September

155
00:06:33,050 --> 00:06:32,550
oh seven and as Kari said so you're

156
00:06:35,390 --> 00:06:33,060
awesome

157
00:06:37,370 --> 00:06:35,400
it's got earth and dawn as they are

158
00:06:40,100 --> 00:06:37,380
right now and you'll see it's almost a

159
00:06:42,140 --> 00:06:40,110
straight line between earth and dawn

160
00:06:43,940 --> 00:06:42,150
and so right now we are in what's called

161
00:06:45,950 --> 00:06:43,950
solar conjunction and that means we

162
00:06:47,390 --> 00:06:45,960
can't talk to the spacecraft as nicely

163
00:06:50,090 --> 00:06:47,400

because the Sun kind of gets in the way

164
00:06:54,470 --> 00:06:50,100
and it's noisy but it only lasts a few

165
00:06:58,160 --> 00:06:54,480
days and we in a couple days we'll hear

166
00:07:02,000 --> 00:06:58,170
from it again so so the so the Sun the

167
00:07:05,800 --> 00:07:02,010
the earth and Ceres are all in kind of a

168
00:07:07,880 --> 00:07:05,810
line right now okay and that's and

169
00:07:10,430 --> 00:07:07,890
that's not an omen

170
00:07:15,200 --> 00:07:10,440
don't worry YouTube commenters it's

171
00:07:17,030 --> 00:07:15,210
nothing really you sure because you know

172
00:07:18,100 --> 00:07:17,040
these are lion-o portents of things to

173
00:07:20,420 --> 00:07:18,110
come

174
00:07:22,400 --> 00:07:20,430
well good but it is preventing this

175
00:07:23,750 --> 00:07:22,410
alignment is preventing you from really

176
00:07:26,030 --> 00:07:23,760
communicating with spacecraft though

177
00:07:28,880 --> 00:07:26,040
right yeah we can hear from it a little

178
00:07:31,220 --> 00:07:28,890
bit but we don't have a really good

179
00:07:32,660 --> 00:07:31,230
connection with the spacecraft it's kind

180
00:07:35,630 --> 00:07:32,670
of like there's a lot of interference on

181
00:07:38,330 --> 00:07:35,640
the line so but just in a couple days

182
00:07:41,060 --> 00:07:38,340
we'll be far enough away from the Sun

183
00:07:42,590 --> 00:07:41,070
that it won't be a problem so because of

184
00:07:44,720 --> 00:07:42,600
the ion drive this thing it's been at it

185
00:07:46,610 --> 00:07:44,730
for a while it's been up in space and

186
00:07:49,370 --> 00:07:46,620
one of the things I I find interesting

187
00:07:52,880 --> 00:07:49,380
is what you say is you sort of try and

188
00:07:54,560 --> 00:07:52,890

match the speed of the object you're

189
00:07:56,960 --> 00:07:54,570
going to go and orbit around or visit

190
00:07:57,860 --> 00:07:56,970
and instead of just blasting there as

191
00:08:00,290 --> 00:07:57,870
quickly as you can

192
00:08:03,920 --> 00:08:00,300
other than patience and a good

193
00:08:05,660 --> 00:08:03,930
understanding of Newtonian mechanics are

194
00:08:07,220 --> 00:08:05,670
there any other challenges involved with

195
00:08:10,610 --> 00:08:07,230
doing that I mean to me what seem like

196
00:08:12,740 --> 00:08:10,620
just getting there would be the

197
00:08:14,690 --> 00:08:12,750
punchline that'd be the best part it is

198
00:08:16,250 --> 00:08:14,700
a cheaper for example or is are there

199
00:08:20,360 --> 00:08:16,260
any advantages for doing it this way

200
00:08:23,300 --> 00:08:20,370
versus the the old-fashioned way so the

201
00:08:26,660 --> 00:08:23,310
advantage of doing this is for less fuel

202
00:08:28,130 --> 00:08:26,670
you're able to visit more bodies and so

203
00:08:32,150 --> 00:08:28,140
we're basically getting two missions for

204
00:08:34,370 --> 00:08:32,160
the price of one right now with thon we

205
00:08:38,150 --> 00:08:34,380
are the first spacecraft ever that will

206
00:08:39,860 --> 00:08:38,160
orbit two different bodies so I think

207
00:08:41,900 --> 00:08:39,870
that's really cool that this ion

208
00:08:44,990 --> 00:08:41,910
propulsion technology has really enabled

209
00:08:48,740 --> 00:08:45,000
us to do these interesting missions okay

210
00:08:50,750 --> 00:08:48,750
so John yang let me ask you you you are

211
00:08:52,170 --> 00:08:50,760
involved with Hubble observations of

212
00:08:55,740 --> 00:08:52,180
Ceres correct

213
00:08:58,080 --> 00:08:55,750

yes and so like what role did Hubble

214
00:08:59,240 --> 00:08:58,090
play in its bubble playing in all of

215
00:09:02,730 --> 00:08:59,250
this

216
00:09:04,650 --> 00:09:02,740
well how about actually you know before

217
00:09:06,480 --> 00:09:04,660
before before tongue has to a serious we

218
00:09:08,370 --> 00:09:06,490
want to know as much as we we know no

219
00:09:10,350 --> 00:09:08,380
one who know as much as we can about

220
00:09:12,630 --> 00:09:10,360
series in order to do our planning work

221
00:09:14,730 --> 00:09:12,640
and that's what Hubble comes into play

222
00:09:16,650 --> 00:09:14,740
and the advantage of Hubble is that

223
00:09:19,740 --> 00:09:16,660
Hubble has the best per solution we can

224
00:09:21,480 --> 00:09:19,750
ever get now right now you know some

225
00:09:22,410 --> 00:09:21,490
people would say okay ground-based you

226
00:09:24,000 --> 00:09:22,420
know there are some very large

227
00:09:26,220 --> 00:09:24,010
ground-based obsolete ground-based

228
00:09:29,370 --> 00:09:26,230
telescopes that can give us good

229
00:09:31,200 --> 00:09:29,380
resolution but you know Hubble although

230
00:09:33,900 --> 00:09:31,210
it's not not as large as those large

231
00:09:35,730 --> 00:09:33,910
ground-based telescopes it's above the

232
00:09:37,890 --> 00:09:35,740
earth atmosphere which is a really

233
00:09:41,250 --> 00:09:37,900
really really good advantage over those

234
00:09:43,980 --> 00:09:41,260
ground-based telescopes so Hubble give

235
00:09:47,460 --> 00:09:43,990
us very high-resolution image of Ceres

236
00:09:50,010 --> 00:09:47,470
in a very stable condition so from her I

237
00:09:52,260 --> 00:09:50,020
mean I would say that so far her

238
00:09:54,750 --> 00:09:52,270

observation of Ceres how images of

239
00:09:56,310 --> 00:09:54,760
seriously in particular give us the most

240
00:09:58,170 --> 00:09:56,320
knowledge about the serving what the

241
00:10:01,410 --> 00:09:58,180
surface of Ceres looks like before don't

242
00:10:02,580 --> 00:10:01,420
guess based on these Hubble images we'll

243
00:10:05,940 --> 00:10:02,590
be able to do a lot of planning work

244
00:10:08,670 --> 00:10:05,950
okay great so Scott's got a an animated

245
00:10:12,450 --> 00:10:08,680
gif going of some early observations of

246
00:10:14,250 --> 00:10:12,460
series back in 2003 2004 is that are

247
00:10:18,210 --> 00:10:14,260
these are these images you you were

248
00:10:21,210 --> 00:10:18,220
involved in yes I was actually fortunate

249
00:10:23,160 --> 00:10:21,220
enough to get him or get to get to get

250
00:10:25,560 --> 00:10:23,170
at the chance to analyze this data when

251
00:10:29,550 --> 00:10:25,570
I was still doing my PhD and I was like

252
00:10:31,260 --> 00:10:29,560
nearly 10 years ago Wow so and we've got

253
00:10:37,650 --> 00:10:31,270
we've got more recent observations cause

254
00:10:39,000 --> 00:10:37,660
somewhere I believe correct yeah this

255
00:10:41,100 --> 00:10:39,010
set of observation this set of

256
00:10:42,930 --> 00:10:41,110
observation are still the best image of

257
00:10:44,700 --> 00:10:42,940
Ceres okay because this data from

258
00:10:46,710 --> 00:10:44,710
observation was taken with the high

259
00:10:49,290 --> 00:10:46,720
resolution channel on the advanced

260
00:10:53,340 --> 00:10:49,300
camera for surveys of Hubble and that

261
00:10:57,030 --> 00:10:53,350
channel is not working anymore so so max

262
00:10:58,110 --> 00:10:57,040
I described for us this data here that

263
00:10:59,520 --> 00:10:58,120

you you are the one you were

264
00:11:01,050 --> 00:10:59,530
instrumental I think in getting some of

265
00:11:04,200 --> 00:11:01,060
your process Breck

266
00:11:04,980 --> 00:11:04,210
yeah so I kind of came late to the to

267
00:11:07,050 --> 00:11:04,990
the game here

268
00:11:10,650 --> 00:11:07,060
I wasn't directly involved I was not a

269
00:11:12,210 --> 00:11:10,660
co I and this program back in 2003 2004

270
00:11:14,540 --> 00:11:12,220
was actually a telecon that I was in

271
00:11:19,320 --> 00:11:14,550
with John yang Lee much later like in

272
00:11:22,080 --> 00:11:19,330
2005 or six I think when he mentioned

273
00:11:24,450 --> 00:11:22,090
that you know the data a typical program

274
00:11:26,730 --> 00:11:24,460
produces lots of data and he was using

275
00:11:28,260 --> 00:11:26,740
some of it there was some also some as

276
00:11:29,850 --> 00:11:28,270
he mentioned some high-resolution

277
00:11:32,630 --> 00:11:29,860
channel images where there was a sub

278
00:11:35,220 --> 00:11:32,640
sampling the other box used which means

279
00:11:37,320 --> 00:11:35,230
we did that the telescope makes small

280
00:11:40,740 --> 00:11:37,330
little shifts to sample an object better

281
00:11:42,900 --> 00:11:40,750
and you can actually get better image

282
00:11:45,930 --> 00:11:42,910
resolution in post-processing of the

283
00:11:47,730 --> 00:11:45,940
image if you do this strategy but then

284
00:11:51,930 --> 00:11:47,740
it's very kind of tricky to put the

285
00:11:53,460 --> 00:11:51,940
image together so I realized that now

286
00:11:55,980 --> 00:11:53,470
this was just a that you know we were

287
00:11:58,680 --> 00:11:55,990
sitting on the best image of series ever

288
00:12:00,780 --> 00:11:58,690

taken and but it was going to take some

289
00:12:03,660 --> 00:12:00,790
work to really put together the image

290
00:12:05,670 --> 00:12:03,670
that you see there and I kind of made a

291
00:12:07,200 --> 00:12:05,680
mental note to myself that all I should

292
00:12:08,280 --> 00:12:07,210
go get that data and do something with

293
00:12:09,960 --> 00:12:08,290
it you know it's been sitting there for

294
00:12:11,190 --> 00:12:09,970
a couple of years and see if I can

295
00:12:13,620 --> 00:12:11,200
produce you know the highest resolution

296
00:12:15,060 --> 00:12:13,630
image and then like but I didn't really

297
00:12:18,510 --> 00:12:15,070
get to it right away but a few months

298
00:12:20,550 --> 00:12:18,520
later this was the summer of 2006 when

299
00:12:24,090 --> 00:12:20,560
the IAE was voting on what is and isn't

300
00:12:25,710 --> 00:12:24,100
the planet and you might recall that the

301
00:12:28,290 --> 00:12:25,720
original proposal was going to be

302
00:12:30,510 --> 00:12:28,300
inclusive include Pluto and you may not

303
00:12:32,820 --> 00:12:30,520
recall that it was going to also include

304
00:12:36,000 --> 00:12:32,830
Ceres Ceres was on the brink of planet

305
00:12:40,500 --> 00:12:36,010
hood in the summer of 2006 it seemed but

306
00:12:41,760 --> 00:12:40,510
it wasn't so so I realized well if you

307
00:12:44,790 --> 00:12:41,770
know Ceres is going to have its

308
00:12:46,440 --> 00:12:44,800
coming-out party and we're sitting on

309
00:12:48,120 --> 00:12:46,450
the best image we better you know do

310
00:12:50,970 --> 00:12:48,130
what we can to generate the best image

311
00:12:53,070 --> 00:12:50,980
and and make sure it's out there on the

312
00:12:54,660 --> 00:12:53,080
day that it becomes a planet well you

313
00:12:56,010 --> 00:12:54,670

know how the story ends that you know

314
00:12:58,890 --> 00:12:56,020
there was an alternative proposal that

315
00:13:00,960 --> 00:12:58,900
was put forth and a more exclusive

316
00:13:04,520 --> 00:13:00,970
definition of planet hood that excluded

317
00:13:07,110 --> 00:13:04,530
both Pluto and Ceres and so nonetheless

318
00:13:09,870 --> 00:13:07,120
it was great to put out you know the

319
00:13:11,310 --> 00:13:09,880
best yet image of Ceres and we literally

320
00:13:13,830 --> 00:13:11,320
put it out on the day of the IU

321
00:13:14,910 --> 00:13:13,840
announcement in the summer of 2006 kind

322
00:13:17,100 --> 00:13:14,920
of quietly we weren't

323
00:13:19,230 --> 00:13:17,110
trying to politicize the image or

324
00:13:21,120 --> 00:13:19,240
suggest one way or the other that this

325
00:13:23,340 --> 00:13:21,130
image you know would determine whether

326
00:13:25,230 --> 00:13:23,350
Ceres is a planet or not but nonetheless

327
00:13:27,690 --> 00:13:25,240
it would have Timmy it would have seemed

328
00:13:29,790 --> 00:13:27,700
almost irresponsible of us to be sitting

329
00:13:31,710 --> 00:13:29,800
on the best image of Ceres and in the

330
00:13:34,160 --> 00:13:31,720
world can't see it I'm really the

331
00:13:37,079 --> 00:13:34,170
biggest day in series life right tonight

332
00:13:39,900 --> 00:13:37,089
so so I was very proud that we were able

333
00:13:42,300 --> 00:13:39,910
to work on that data and generate that

334
00:13:44,160 --> 00:13:42,310
that image from the older data which I

335
00:13:45,800 --> 00:13:44,170
think Joel Parker and Lucy McFadden and

336
00:13:48,090 --> 00:13:45,810
John yang had been working on for years

337
00:13:49,910 --> 00:13:48,100
and getting good science results from

338
00:13:52,170 --> 00:13:49,920

very important science results so uh

339
00:13:54,000 --> 00:13:52,180
yeah sort of you know it sort of ties

340
00:13:55,620 --> 00:13:54,010
into that whole planet debate and and

341
00:13:58,170 --> 00:13:55,630
and so that's why that image actually

342
00:14:00,210 --> 00:13:58,180
came out several years after it was

343
00:14:02,129 --> 00:14:00,220
obtained it was obtained what in 2003

344
00:14:04,319 --> 00:14:02,139
and I guess it was summer of 2006 when

345
00:14:06,720 --> 00:14:04,329
we actually created and released the

346
00:14:08,069 --> 00:14:06,730
image that we were just seeing cool so

347
00:14:09,930 --> 00:14:08,079
I've got it so here's what we're talking

348
00:14:11,670 --> 00:14:09,940
about folks I have a graphic up here

349
00:14:13,949 --> 00:14:11,680
about this shows though the various

350
00:14:18,420 --> 00:14:13,959
comparisons of sizes to different

351
00:14:19,620 --> 00:14:18,430
objects in the solar system and Carrie

352
00:14:21,300 --> 00:14:19,630
could I get you to comment on this a

353
00:14:23,579 --> 00:14:21,310
little bit you can see how big series is

354
00:14:26,210 --> 00:14:23,589
compared to Vesta what are these other

355
00:14:29,130 --> 00:14:26,220
things that are listed in here as well

356
00:14:30,329 --> 00:14:29,140
yeah so the other asteroids listed are

357
00:14:33,420 --> 00:14:30,339
some of the asteroids that we've

358
00:14:35,670 --> 00:14:33,430
explored with different spacecraft so

359
00:14:38,759 --> 00:14:35,680
just to give you a different idea of the

360
00:14:42,569 --> 00:14:38,769
size the diameter of Ceres is about the

361
00:14:45,810 --> 00:14:42,579
diameter of Texas invested same concept

362
00:14:48,269 --> 00:14:45,820
but with Arizona so they're really big

363
00:14:50,310 --> 00:14:48,279

compared to all the other asteroids that

364
00:14:51,930 --> 00:14:50,320
we've explored and so all the other

365
00:14:53,910 --> 00:14:51,940
asteroids are just these little lumps of

366
00:14:57,750 --> 00:14:53,920
rock but series investor are just

367
00:15:00,090 --> 00:14:57,760
completely different and so Ceres is the

368
00:15:02,519 --> 00:15:00,100
dwarf planet and Vesta is a proto planet

369
00:15:05,340 --> 00:15:02,529
it was trying to form a to be a planet

370
00:15:07,019 --> 00:15:05,350
never quite made it so they're not quite

371
00:15:12,769 --> 00:15:07,029
just the lumps of rock floating around

372
00:15:16,620 --> 00:15:12,779
in the asteroid belt okay so the the

373
00:15:18,420 --> 00:15:16,630
there's lots of different sizes here and

374
00:15:21,030 --> 00:15:18,430
obviously Ceres is the largest in there

375
00:15:25,639 --> 00:15:21,040
John yay can I can I get you to give us

376
00:15:28,759 --> 00:15:25,649
a comment on how important are these

377
00:15:31,999 --> 00:15:28,769
these small worlds like Ceres in Seoul

378
00:15:33,379 --> 00:15:32,009
systems do they play any special role in

379
00:15:34,910 --> 00:15:33,389
the formation of planets or are they

380
00:15:37,340 --> 00:15:34,920
just a byproduct of solar system

381
00:15:38,379 --> 00:15:37,350
formation what exactly are bodies like

382
00:15:41,869 --> 00:15:38,389
Ceres

383
00:15:43,850 --> 00:15:41,879
well Dominion was depending on how you

384
00:15:45,530 --> 00:15:43,860
think about these small objects you get

385
00:15:48,079 --> 00:15:45,540
you know different analyst and Annalee

386
00:15:49,910 --> 00:15:48,089
analogies some people say okay these are

387
00:15:52,489 --> 00:15:49,920
the building blocks of their planets of

388
00:15:53,710 --> 00:15:52,499

the planetary system because you know

389
00:15:57,859 --> 00:15:53,720
you know in the early solar system

390
00:15:59,689 --> 00:15:57,869
weirdos the dust that condensed out from

391
00:16:01,729 --> 00:15:59,699
the gas first NATO made out of their

392
00:16:04,489 --> 00:16:01,739
small bodies and then those small bodies

393
00:16:07,249 --> 00:16:04,499
accrete and grow and kneeled to today's

394
00:16:09,919 --> 00:16:07,259
big planets but then during this process

395
00:16:12,259 --> 00:16:09,929
a lot of a large fraction of these you

396
00:16:14,840 --> 00:16:12,269
know these small bodies are actually

397
00:16:17,509 --> 00:16:14,850
ejected out of solar system and also on

398
00:16:20,780 --> 00:16:17,519
their son left you know most of them are

399
00:16:23,720 --> 00:16:20,790
in the current currently in in-between

400
00:16:26,239 --> 00:16:23,730
the orbit of Mars and Jupiter and those

401
00:16:28,970 --> 00:16:26,249
are what we know today as as the main

402
00:16:30,619 --> 00:16:28,980
belt men asteroid belt and then those

403
00:16:32,119 --> 00:16:30,629
those small bodies they collide with

404
00:16:33,829 --> 00:16:32,129
each other like when each with each

405
00:16:36,259 --> 00:16:33,839
other and they they become small

406
00:16:38,150 --> 00:16:36,269
fragments so in that sense you can say

407
00:16:40,100 --> 00:16:38,160
okay these are probably the junkyard of

408
00:16:42,410 --> 00:16:40,110
a solar system but I would say that

409
00:16:44,869 --> 00:16:42,420
these are probably you know I think I

410
00:16:47,480 --> 00:16:44,879
like the I like the analogy I like the

411
00:16:49,489 --> 00:16:47,490
best a star these are the fossils of the

412
00:16:53,119 --> 00:16:49,499
solar system because you know these are

413
00:16:54,859 --> 00:16:53,129

the the ODE remnants from the formation

414
00:16:56,600 --> 00:16:54,869
of the solar system and then they're

415
00:16:58,669 --> 00:16:56,610
preserved so well that we can still

416
00:17:00,650 --> 00:16:58,679
study today to infer what's going on at

417
00:17:02,869 --> 00:17:00,660
the beginning of the solar system so I

418
00:17:05,929 --> 00:17:02,879
have a graphic up of what I guess you

419
00:17:09,169 --> 00:17:05,939
guys think series is made of there's

420
00:17:12,590 --> 00:17:09,179
this there's layers to it apparently can

421
00:17:18,620 --> 00:17:12,600
you comment on this diagram what I see

422
00:17:20,240 --> 00:17:18,630
is a Hubble logo you do okay John yang

423
00:17:22,730 --> 00:17:20,250
what what they're showing is sort of an

424
00:17:25,429 --> 00:17:22,740
artist's rendering of different

425
00:17:27,860 --> 00:17:25,439
differentiation of the core of series so

426
00:17:29,060 --> 00:17:27,870
showing the thin dusty outer crust the

427
00:17:31,810 --> 00:17:29,070
rocky inner core and then most

428
00:17:36,409 --> 00:17:31,820
excitingly the water ice layer right

429
00:17:38,539 --> 00:17:36,419
yeah no I said okay good yeah probably

430
00:17:39,720 --> 00:17:38,549
because I'm using the Wi-Fi wireless

431
00:17:41,580 --> 00:17:39,730
today and my

432
00:17:47,390 --> 00:17:41,590
even actually it's probably not not that

433
00:17:52,440 --> 00:17:51,060
this is an interesting diagram so yeah

434
00:17:54,510 --> 00:17:52,450
I'd like you to comment on a little bit

435
00:17:56,789 --> 00:17:54,520
and maybe tell us how we know that why

436
00:17:59,760 --> 00:17:56,799
we think there might be these water ice

437
00:18:02,039 --> 00:17:59,770
layers in there sure yeah

438
00:18:03,930 --> 00:18:02,049

so at the beginning people we know much

439
00:18:06,030 --> 00:18:03,940
about series everybody I think okay

440
00:18:09,030 --> 00:18:06,040
serious you know it's just a big big

441
00:18:11,970 --> 00:18:09,040
chunk of rock and it's it's the same

442
00:18:13,470 --> 00:18:11,980
everywhere inside well no matter whether

443
00:18:15,560 --> 00:18:13,480
you are sitting on the surface or you'll

444
00:18:17,880 --> 00:18:15,570
go into the into the center of the body

445
00:18:19,799 --> 00:18:17,890
so that's what we call that and

446
00:18:22,680 --> 00:18:19,809
differentiate it that means everywhere

447
00:18:24,690 --> 00:18:22,690
it's the same inside and then what makes

448
00:18:27,030 --> 00:18:24,700
it differentiate it that's you know if

449
00:18:31,200 --> 00:18:27,040
it has enough like we call that

450
00:18:32,940 --> 00:18:31,210
radioactive heating then it was the

451
00:18:34,919 --> 00:18:32,950
temperature and the temperature inside

452
00:18:37,500 --> 00:18:34,929
series were increased and then that will

453
00:18:39,419 --> 00:18:37,510
melt the material and then different

454
00:18:41,669 --> 00:18:39,429
material with different melting point

455
00:18:43,680 --> 00:18:41,679
with different density there were there

456
00:18:45,659 --> 00:18:43,690
were you know sink two different tabs

457
00:18:48,870 --> 00:18:45,669
and that makes it differentiate it and

458
00:18:51,450 --> 00:18:48,880
we actually know this result from the

459
00:18:53,280 --> 00:18:51,460
Hubble data from the 2003 - and for

460
00:18:55,560 --> 00:18:53,290
Hubble data I just you just a soul and

461
00:18:57,330 --> 00:18:55,570
from that data we measure the shape we

462
00:19:00,030 --> 00:18:57,340
measure the density of series and then

463
00:19:01,919 --> 00:19:00,040

from that people can make some models

464
00:19:04,530 --> 00:19:01,929
and in the models people think okay

465
00:19:06,990 --> 00:19:04,540
series is most likely differentiated to

466
00:19:10,130 --> 00:19:07,000
a core and metal and a crust like this

467
00:19:13,890 --> 00:19:10,140
like what you see here in this graph and

468
00:19:16,049 --> 00:19:13,900
and also from that set of data we simply

469
00:19:17,730 --> 00:19:16,059
measure that density and we have some

470
00:19:19,890 --> 00:19:17,740
idea about you know the densities are

471
00:19:22,799 --> 00:19:19,900
like twice of the density of water and

472
00:19:24,390 --> 00:19:22,809
then we also we also have some idea

473
00:19:26,840 --> 00:19:24,400
about what's the composition series

474
00:19:30,299 --> 00:19:26,850
which is more like you know carbonaceous

475
00:19:32,190 --> 00:19:30,309
chondrite which is like like you know

476
00:19:34,140 --> 00:19:32,200
carbonates on the earth

477
00:19:37,470 --> 00:19:34,150
no not carbonates by something like that

478
00:19:39,090 --> 00:19:37,480
made up of carbon minerals okay so we

479
00:19:41,970 --> 00:19:39,100
know the intensity of those things are

480
00:19:43,980 --> 00:19:41,980
like three so that that tells us that

481
00:19:47,010 --> 00:19:43,990
okay you know there must be something

482
00:19:49,500 --> 00:19:47,020
that's less dense than then blocking

483
00:19:53,160 --> 00:19:49,510
series and most likely composition would

484
00:19:55,110 --> 00:19:53,170
be water and so from those calculation

485
00:19:57,480 --> 00:19:55,120
we thought that okay they should be like

486
00:19:59,910 --> 00:19:57,490
a quarter of the mass in series made of

487
00:20:02,370 --> 00:19:59,920
water so that's what you see here and

488
00:20:04,140 --> 00:20:02,380

you know theoretically rockets they came

489
00:20:07,110 --> 00:20:04,150
in and then they use on their models

490
00:20:09,750 --> 00:20:07,120
then they say okay so series should have

491
00:20:12,180 --> 00:20:09,760
its water you know above the chord

492
00:20:14,670 --> 00:20:12,190
course mostly like rocky and dry and

493
00:20:17,520 --> 00:20:14,680
then the water will you know be above

494
00:20:20,340 --> 00:20:17,530
the rocky core and that the and those

495
00:20:21,990 --> 00:20:20,350
water might be you know liquids and it

496
00:20:23,700 --> 00:20:22,000
should be liquid at the beginning when

497
00:20:25,890 --> 00:20:23,710
the temperature is high enough and then

498
00:20:28,050 --> 00:20:25,900
as the temperature goes went on and the

499
00:20:30,840 --> 00:20:28,060
this this water will condense and will

500
00:20:33,930 --> 00:20:30,850
freeze to ice and that's what most work

501
00:20:36,870 --> 00:20:33,940
water should be like today you know it's

502
00:20:38,940 --> 00:20:36,880
a big layer of ice and also they might

503
00:20:40,050 --> 00:20:38,950
even be some small errors with liquid

504
00:20:41,580 --> 00:20:40,060
water that's people are really

505
00:20:44,340 --> 00:20:41,590
interested because if you have liquid

506
00:20:45,660 --> 00:20:44,350
water than before you usually I imagine

507
00:20:49,590 --> 00:20:45,670
eight and they would think okay then

508
00:20:51,570 --> 00:20:49,600
maybe some kind of right and so yeah so

509
00:20:55,110 --> 00:20:51,580
that's exciting I mean that that's real

510
00:20:56,750 --> 00:20:55,120
and Mac sent me an image earlier that

511
00:21:01,530 --> 00:20:56,760
I'm gonna share here just okay

512
00:21:04,110 --> 00:21:01,540
comparison is the the amount of water we

513
00:21:05,820 --> 00:21:04,120

were seeing there on Ceres compared to

514
00:21:10,020 --> 00:21:05,830
the amount of fresh water we see here on

515
00:21:12,540 --> 00:21:10,030
earth yeah this graphic is just showing

516
00:21:14,760 --> 00:21:12,550
water there is on earth this is from the

517
00:21:17,430 --> 00:21:14,770
USGS they have I love this graphic that

518
00:21:18,870 --> 00:21:17,440
they've produced it shows you know that

519
00:21:20,520 --> 00:21:18,880
earth really doesn't have as much water

520
00:21:22,350 --> 00:21:20,530
as you think I mean we know earth is

521
00:21:24,480 --> 00:21:22,360
cover covered with seventy percent water

522
00:21:26,250 --> 00:21:24,490
but really it's like basically

523
00:21:30,030 --> 00:21:26,260
paper-thin it's really not as much water

524
00:21:31,590 --> 00:21:30,040
as you think it's and so if you scoop it

525
00:21:33,030 --> 00:21:31,600
all up into a sphere you see that you

526
00:21:34,440 --> 00:21:33,040
know all the water on earth isn't much

527
00:21:37,020 --> 00:21:34,450
bigger than Texas and all the fresh

528
00:21:39,630 --> 00:21:37,030
water is even smaller and all the water

529
00:21:41,010 --> 00:21:39,640
the groundwater is you know including

530
00:21:42,090 --> 00:21:41,020
all the groundwater and things like that

531
00:21:43,530 --> 00:21:42,100
I think there's three different blobs

532
00:21:44,790 --> 00:21:43,540
they're reflecting different you know

533
00:21:46,890 --> 00:21:44,800
depending on how much water you're

534
00:21:48,870 --> 00:21:46,900
counting but you know one of the moments

535
00:21:51,210 --> 00:21:48,880
oh wait wait hang on the big blob is all

536
00:21:53,010 --> 00:21:51,220
the seawater saltwater I think that's

537
00:21:55,050 --> 00:21:53,020
all the water on earth whether it's in

538
00:22:00,300 --> 00:21:55,060

the oceans or freshwater or beneath the

539
00:22:02,280 --> 00:22:00,310
ground you can read the okay I'm all the

540
00:22:04,440 --> 00:22:02,290
water including freshwater and saltwater

541
00:22:06,720 --> 00:22:04,450
okay and then the little dive I think it

542
00:22:08,640 --> 00:22:06,730
might include ground water I'm not sure

543
00:22:10,560 --> 00:22:08,650
but but then this the next one I think

544
00:22:12,840 --> 00:22:10,570
is freshwater and I don't know what the

545
00:22:15,900 --> 00:22:12,850
smallest one is it might just be rivers

546
00:22:17,970 --> 00:22:15,910
or something but you get an idea that

547
00:22:19,590 --> 00:22:17,980
you know there isn't as much water on

548
00:22:22,289 --> 00:22:19,600
earth as you might think just looking at

549
00:22:25,169 --> 00:22:22,299
the Big Blue Marble you know and some

550
00:22:26,909 --> 00:22:25,179
illustrative you know one of the one of

551
00:22:28,740 --> 00:22:26,919
the amazing factoids you know you look

552
00:22:30,720 --> 00:22:28,750
at that diagram that we're just looking

553
00:22:32,100 --> 00:22:30,730
at if how much water ice is that the

554
00:22:33,990 --> 00:22:32,110
simple fact that there could be more

555
00:22:35,909 --> 00:22:34,000
fresh water on unserious than there is

556
00:22:37,320 --> 00:22:35,919
on earth you know that fact at first

557
00:22:38,850 --> 00:22:37,330
when like when you first hear that it

558
00:22:40,650 --> 00:22:38,860
sounds crazy how can that possibly be

559
00:22:42,120 --> 00:22:40,660
true but when you look at this graphic

560
00:22:44,159 --> 00:22:42,130
you see it's actually not that difficult

561
00:22:46,490 --> 00:22:44,169
for it to be true um but nonetheless

562
00:22:48,930 --> 00:22:46,500
it's still amazing if you think about

563
00:22:51,630 --> 00:22:48,940

how much you know finding water in the

564
00:22:56,100 --> 00:22:51,640
solar system is a driving scientific you

565
00:22:58,320 --> 00:22:56,110
know goal that if Ceres is loaded with

566
00:22:59,700 --> 00:22:58,330
water as we think it might be then it

567
00:23:03,510 --> 00:22:59,710
makes series a much more exciting

568
00:23:05,549 --> 00:23:03,520
astrobiological you know consideration

569
00:23:07,530 --> 00:23:05,559
in the solar system and it's much closer

570
00:23:09,810 --> 00:23:07,540
than a lot of the other places we're

571
00:23:12,630 --> 00:23:09,820
considering you know like Enceladus and

572
00:23:14,159 --> 00:23:12,640
Europa and other outer moons of this

573
00:23:15,720 --> 00:23:14,169
outer solar system so it's a kind of

574
00:23:17,730 --> 00:23:15,730
exciting that now there's this water

575
00:23:20,100 --> 00:23:17,740
world that's actually much much closer

576
00:23:21,480 --> 00:23:20,110
it's in the asteroid belt so a little

577
00:23:22,919 --> 00:23:21,490
farther away than Mars which of course

578
00:23:25,440 --> 00:23:22,929
is also very exciting and interesting

579
00:23:27,360 --> 00:23:25,450
and well studied but I often think that

580
00:23:30,180 --> 00:23:27,370
boy I would love to send a rover to

581
00:23:32,549 --> 00:23:30,190
Ceres no kidding look at this John Yanks

582
00:23:35,880 --> 00:23:32,559
got a thing up here says series is for

583
00:23:38,610 --> 00:23:35,890
about 40 percent by volume of water

584
00:23:41,820 --> 00:23:38,620
compared to very tiny amounts for Earth

585
00:23:44,789 --> 00:23:41,830
and Mars you wanna comment well yeah yes

586
00:23:47,100 --> 00:23:44,799
let me explain this figure actually we

587
00:23:48,659 --> 00:23:47,110
made this speaker like last year and we

588
00:23:51,210 --> 00:23:48,669

thought it's a very good illustration

589
00:23:53,310 --> 00:23:51,220
for relatively how much water series

590
00:23:55,110 --> 00:23:53,320
might have we have to say might have

591
00:23:58,890 --> 00:23:55,120
because we're not sure completely sure

592
00:24:00,990 --> 00:23:58,900
yet okay to be cautious and so so and

593
00:24:03,690 --> 00:24:01,000
also I presented this figure in one of

594
00:24:06,570 --> 00:24:03,700
the meetings at space static Space

595
00:24:08,100 --> 00:24:06,580
Telescope Science Institute so what what

596
00:24:10,260 --> 00:24:08,110
do you see here there are three big

597
00:24:11,730 --> 00:24:10,270
spheres and the blue one you know I

598
00:24:13,980 --> 00:24:11,740
worked in ice that's the earth and then

599
00:24:15,630 --> 00:24:13,990
the the the sort of a yellow pear on one

600
00:24:17,669 --> 00:24:15,640
that's Mars and then there's another

601
00:24:18,120 --> 00:24:17,679
small one kind of reddish compared to

602
00:24:20,430 --> 00:24:18,130
others

603
00:24:20,700 --> 00:24:20,440
that's series so and the size of this

604
00:24:23,220 --> 00:24:20,710
ball

605
00:24:25,710 --> 00:24:23,230
on scale so these are they were their

606
00:24:28,139 --> 00:24:25,720
relative size then we got three our

607
00:24:30,509 --> 00:24:28,149
water sphere here these artists water

608
00:24:33,389 --> 00:24:30,519
all the water that we thought contained

609
00:24:36,359 --> 00:24:33,399
by all these different bodies so Earth

610
00:24:38,310 --> 00:24:36,369
has this much water and in dots and

611
00:24:39,899 --> 00:24:38,320
compared to the total volume of the

612
00:24:42,389 --> 00:24:39,909
earth there's only like point one

613
00:24:45,239 --> 00:24:42,399

percent of the earth body and then for

614
00:24:47,580 --> 00:24:45,249
Mars it has less water than and what's

615
00:24:49,830 --> 00:24:47,590
on and compared to my total volume Mars

616
00:24:52,649 --> 00:24:49,840
is at the count four point zero five

617
00:24:56,129 --> 00:24:52,659
fourteen percent more than there is

618
00:24:57,960 --> 00:24:56,139
another another water sphere for series

619
00:25:00,359 --> 00:24:57,970
and then based on our current standing

620
00:25:02,249 --> 00:25:00,369
Sirius has 40 percent of its volume in

621
00:25:04,649 --> 00:25:02,259
water I mean I should I should not say

622
00:25:06,570 --> 00:25:04,659
this okay sorry I should say if we take

623
00:25:08,669 --> 00:25:06,580
all the water from series out and make

624
00:25:10,649 --> 00:25:08,679
it a sphere then there's the volume of

625
00:25:16,350 --> 00:25:10,659
that sphere is forty percent of the

626
00:25:18,389 --> 00:25:16,360
volume of series okay Wow yeah and and

627
00:25:20,489 --> 00:25:18,399
from here from here what we think is

628
00:25:23,159 --> 00:25:20,499
that you know in the inner solar system

629
00:25:25,230 --> 00:25:23,169
which we say is reading the reading

630
00:25:27,239 --> 00:25:25,240
tubular okay inside including the small

631
00:25:29,609 --> 00:25:27,249
main asteroid belt including the Earth

632
00:25:32,999 --> 00:25:29,619
Mars and what anything inside like

633
00:25:35,310 --> 00:25:33,009
Mercury Venus and anything there and if

634
00:25:37,259 --> 00:25:35,320
you compare this graph you can be

635
00:25:39,239 --> 00:25:37,269
impression that Earth has the has the

636
00:25:39,720 --> 00:25:39,249
most water and then the next would be

637
00:25:43,680 --> 00:25:39,730
serious

638
00:25:44,940 --> 00:25:43,690

reservoir in the inner solar system

639
00:25:47,460 --> 00:25:44,950
other than the earth

640
00:25:49,049 --> 00:25:47,470
that's impressive yeah yeah and I gotta

641
00:25:51,119 --> 00:25:49,059
say the real shocking thing was just

642
00:25:53,940 --> 00:25:51,129
that had the percentage by volume of

643
00:25:56,399 --> 00:25:53,950
water that Earth that Earth has was I

644
00:25:58,440 --> 00:25:56,409
had no idea that I mean you're right you

645
00:25:59,850 --> 00:25:58,450
think you know all the planet surfaces

646
00:26:01,049 --> 00:25:59,860
cover most of the planet surface is

647
00:26:02,279 --> 00:26:01,059
covered with water you think it's got

648
00:26:04,200 --> 00:26:02,289
more than it does that was a real

649
00:26:08,039 --> 00:26:04,210
eye-opener so thanks for showing that so

650
00:26:10,769 --> 00:26:08,049
Hubble has set the stage for Dawn it is

651
00:26:13,710 --> 00:26:10,779
it is imaged it is imaged this minor

652
00:26:15,930 --> 00:26:13,720
planet and given us some some data with

653
00:26:17,489 --> 00:26:15,940
which to work and so I want to get I

654
00:26:20,190 --> 00:26:17,499
want to go move to dawn now but I want

655
00:26:22,560 --> 00:26:20,200
to start with a QA from Albert Bundy on

656
00:26:24,659 --> 00:26:22,570
the Q&A app who's asking will there and

657
00:26:26,369 --> 00:26:24,669
this is a good segue into into this and

658
00:26:28,769 --> 00:26:26,379
carry maybe you can address this for us

659
00:26:32,279 --> 00:26:28,779
will there be a difference between what

660
00:26:34,240 --> 00:26:32,289
Hubble is showing versus what the new

661
00:26:37,000 --> 00:26:34,250
Space Telescope and Dawn will

662
00:26:39,010 --> 00:26:37,010
and showing detailed pictures of Ceres

663
00:26:40,930 --> 00:26:39,020

so I guess when I add the way entropy

664
00:26:43,600 --> 00:26:40,940
that is what will what will series or

665
00:26:44,830 --> 00:26:43,610
what will dawn show us that we can't see

666
00:26:53,620 --> 00:26:44,840
with Hubble what do we hope for hoping

667
00:26:55,990 --> 00:26:53,630
to learn are you there yes I think you

668
00:26:57,159 --> 00:26:56,000
know it's hard to say what new surprises

669
00:26:58,870 --> 00:26:57,169
we're going to have but we're going to

670
00:27:01,270 --> 00:26:58,880
have such high resolution pictures

671
00:27:03,279 --> 00:27:01,280
compared to what we have and we were

672
00:27:05,860 --> 00:27:03,289
surprised at Vesta even though we had

673
00:27:07,690 --> 00:27:05,870
Hubble images and so I'm sure we'll be

674
00:27:09,850 --> 00:27:07,700
surprised with whatever Ceres has in

675
00:27:12,159 --> 00:27:09,860
store for us and I'd like to think of

676
00:27:13,810 --> 00:27:12,169
Donna's like a detective and we have our

677
00:27:16,690 --> 00:27:13,820
instruments and we're going to the scene

678
00:27:18,580 --> 00:27:16,700
and we're going to investigate all the

679
00:27:22,000 --> 00:27:18,590
different things that series has to

680
00:27:23,529 --> 00:27:22,010
reveal for us so I don't know what

681
00:27:26,490 --> 00:27:23,539
Sirius has in store for us but we'll

682
00:27:29,919 --> 00:27:26,500
find out yeah I guess I will say that

683
00:27:31,750 --> 00:27:29,929
recently there was a paper released by

684
00:27:34,870 --> 00:27:31,760
the Herschel Space Observatory that

685
00:27:37,570 --> 00:27:34,880
found water vapour around Ceres so

686
00:27:39,940 --> 00:27:37,580
series has some sort of mechanism that's

687
00:27:44,110 --> 00:27:39,950
putting water vapor and and causing kind

688
00:27:45,970 --> 00:27:44,120

of a thin temporary atmosphere and my

689
00:27:47,470 --> 00:27:45,980
background is in meteorology so I think

690
00:27:50,710 --> 00:27:47,480
it's very nice that series decided to

691
00:27:58,680 --> 00:27:50,720
have an atmosphere for me and so and

692
00:28:05,260 --> 00:28:03,159
you know I I think that we're gonna try

693
00:28:07,029 --> 00:28:05,270
and look into this and then we don't

694
00:28:09,970 --> 00:28:07,039
know what else series will have them in

695
00:28:11,710 --> 00:28:09,980
store for us so I think it'll be a very

696
00:28:14,590 --> 00:28:11,720
exciting mission over the next year

697
00:28:16,659 --> 00:28:14,600
awesome ok so that was a good question

698
00:28:18,460 --> 00:28:16,669
Thank You Albert I appreciate it well

699
00:28:22,539 --> 00:28:18,470
then I want to share an image real quick

700
00:28:26,799 --> 00:28:22,549
to just an example of what Dawn's you

701
00:28:28,270 --> 00:28:26,809
with Vesta so here is an image also in

702
00:28:30,730 --> 00:28:28,280
the festive season since we are in

703
00:28:35,140 --> 00:28:30,740
December so here's a snowman on Vesta

704
00:28:36,669 --> 00:28:35,150
but this was taken with with Dawn so

705
00:28:40,240 --> 00:28:36,679
this is what we've been able to see an

706
00:28:43,000 --> 00:28:40,250
even smaller planetary body but the that

707
00:28:47,350 --> 00:28:43,010
this is what dawn is going to be able to

708
00:28:48,029 --> 00:28:47,360
see on Vesta much much higher resolution

709
00:28:50,940 --> 00:28:48,039
than we've been able

710
00:28:52,349 --> 00:28:50,950
with Hubble right so right now Hubble is

711
00:28:55,560 --> 00:28:52,359
still able to do a slightly better job

712
00:28:58,619 --> 00:28:55,570
than dawn is but you were saying by what

713
00:29:03,379 --> 00:28:58,629

time carry will will dawn be doing a

714
00:29:06,889 --> 00:29:03,389
better job than Hubble January 25th so

715
00:29:09,330 --> 00:29:06,899
and you said it was going to be about

716
00:29:10,529 --> 00:29:09,340
one and a half times better than the

717
00:29:11,639 --> 00:29:10,539
Hubble resolution and then it's just

718
00:29:13,529 --> 00:29:11,649
gonna keep getting better from there

719
00:29:15,749 --> 00:29:13,539
correct yep

720
00:29:17,249 --> 00:29:15,759
okay and we add Hubble couldn't be more

721
00:29:20,759 --> 00:29:17,259
thrilled that our images are going to be

722
00:29:23,099 --> 00:29:20,769
very obsolete I think that's awesome I

723
00:29:25,049 --> 00:29:23,109
agree because of course most of the

724
00:29:26,460 --> 00:29:25,059
solar system objects we observe with

725
00:29:29,430 --> 00:29:26,470
Hubble will never be visited by a

726
00:29:31,889 --> 00:29:29,440
spacecraft so when they are it's really

727
00:29:33,539 --> 00:29:31,899
exciting so I got you up here maxin you

728
00:29:35,879 --> 00:29:33,549
I'm let's go back to the data for a

729
00:29:38,039 --> 00:29:35,889
minute for Hubble data you've got some

730
00:29:39,359 --> 00:29:38,049
raw images right of what these data look

731
00:29:40,499 --> 00:29:39,369
like can you just kind of maybe share

732
00:29:42,389 --> 00:29:40,509
with us a little bit about how this

733
00:29:44,339 --> 00:29:42,399
stuff comes off the telescope I know

734
00:29:46,830 --> 00:29:44,349
we've done this before but not everybody

735
00:29:48,149 --> 00:29:46,840
is seen every Hubble hangout so it's

736
00:29:50,549 --> 00:29:48,159
always nice to show people what Hubble

737
00:29:53,249 --> 00:29:50,559
gives us and what you what magic you do

738
00:29:55,739 --> 00:29:53,259

with it sure yeah actually didn't have

739
00:29:57,389 --> 00:29:55,749
the raw data six years ago sorry I did I

740
00:29:59,009 --> 00:29:57,399
did just get some and I pulled one up

741
00:30:01,830 --> 00:29:59,019
I'm not sure it's the best example but

742
00:30:03,149 --> 00:30:01,840
I'll do a screen share here I guess so

743
00:30:05,549 --> 00:30:03,159
yeah I mentioned that there was quite a

744
00:30:16,649 --> 00:30:05,559
bit of work to turn you know the raw

745
00:30:18,659 --> 00:30:16,659
images into a screen share okay let me

746
00:30:19,950 --> 00:30:18,669
know if you're seeing an image here okay

747
00:30:22,619 --> 00:30:19,960
you got it

748
00:30:25,259 --> 00:30:22,629
yep I got it out okay so a not so

749
00:30:28,109 --> 00:30:25,269
impressive image of Ceres here from 2003

750
00:30:31,469 --> 00:30:28,119
where a couple of things first it looks

751
00:30:34,200 --> 00:30:31,479
like an egg yeah because Hubble produces

752
00:30:35,399 --> 00:30:34,210
distorted images it's one of the ways

753
00:30:36,989 --> 00:30:35,409
we're so sensitive is that we minimize

754
00:30:38,580 --> 00:30:36,999
number of reflections and so we don't

755
00:30:40,339 --> 00:30:38,590
bother to do an extra one that would

756
00:30:43,680 --> 00:30:40,349
then under storage so we have to

757
00:30:45,149 --> 00:30:43,690
understand processing you also notice a

758
00:30:47,580 --> 00:30:45,159
whole bunch of flex in the image those

759
00:30:49,349 --> 00:30:47,590
are cosmic rays which are just flying

760
00:30:50,789 --> 00:30:49,359
around space high-energy particles that

761
00:30:53,369 --> 00:30:50,799
just go shooting through every single

762
00:30:54,989 --> 00:30:53,379
image so we have to have ways to clean

763
00:30:58,229 --> 00:30:54,999

them out and generally we take multiple

764
00:31:01,680 --> 00:30:58,239
exposures and combine them to get rid of

765
00:31:02,999 --> 00:31:01,690
the junk and in this case so I'm

766
00:31:04,860 --> 00:31:03,009
in that you know we took a series of

767
00:31:06,269 --> 00:31:04,870
images and shifted them each a little

768
00:31:08,070 --> 00:31:06,279
bit so if i zoom way in you can actually

769
00:31:11,610 --> 00:31:08,080
see the individual pixels kind of starts

770
00:31:13,230 --> 00:31:11,620
to look like a pile of Legos you know

771
00:31:15,119 --> 00:31:13,240
you start to see the individual pixels

772
00:31:18,090 --> 00:31:15,129
and if we do little shifts on the order

773
00:31:19,409 --> 00:31:18,100
of like half of those pixels we can

774
00:31:21,690 --> 00:31:19,419
actually sample the image you can see

775
00:31:24,570 --> 00:31:21,700
I'm trying to stretch it but as best I

776
00:31:27,810 --> 00:31:24,580
can and you still can't see many service

777
00:31:29,539 --> 00:31:27,820
features like this and very pixelated so

778
00:31:33,330 --> 00:31:29,549
that's kind of what I'm starting with

779
00:31:36,360 --> 00:31:33,340
and you know sort of clean up the image

780
00:31:38,759 --> 00:31:36,370
under store at them combine them at a

781
00:31:40,409 --> 00:31:38,769
smaller pixel scale so extracting as

782
00:31:41,789 --> 00:31:40,419
much spatial information from each of

783
00:31:43,379 --> 00:31:41,799
the individual images and then combining

784
00:31:45,930 --> 00:31:43,389
it into that high resolution image that

785
00:31:47,249 --> 00:31:45,940
you see in the in that nice color press

786
00:31:48,720 --> 00:31:47,259
release image and of course then we did

787
00:31:50,610 --> 00:31:48,730
two filters so you could get a nice

788
00:31:52,409 --> 00:31:50,620

color image so that just gives you an

789
00:31:53,850 --> 00:31:52,419
idea of you know what the raw data comes

790
00:31:55,350 --> 00:31:53,860
it doesn't come shooting out of the

791
00:31:56,820 --> 00:31:55,360
telescope looking like the press release

792
00:31:58,440 --> 00:31:56,830
images there's you know usually a fair

793
00:31:59,820 --> 00:31:58,450
amount of work I always like to point

794
00:32:03,119 --> 00:31:59,830
that out when I have you on the hangouts

795
00:32:04,379 --> 00:32:03,129
because you you you do you know you're

796
00:32:06,029 --> 00:32:04,389
not inventing anything but you're

797
00:32:09,450 --> 00:32:06,039
removing artifacts and you're trying to

798
00:32:11,639 --> 00:32:09,460
get the details that the actual science

799
00:32:14,220 --> 00:32:11,649
units teased out of these images and I

800
00:32:15,840 --> 00:32:14,230
always like to to bring that up I carry

801
00:32:17,430 --> 00:32:15,850
you I have a question for you and this

802
00:32:18,659 --> 00:32:17,440
may this may not be a fair question and

803
00:32:22,560 --> 00:32:18,669
I hope I'm not putting you on the spot

804
00:32:24,659 --> 00:32:22,570
but how do the cameras on dawn do you

805
00:32:27,419 --> 00:32:24,669
know how they compare to the cameras on

806
00:32:30,690 --> 00:32:27,429
Hubble or are they higher resolution are

807
00:32:32,610 --> 00:32:30,700
they different wavelengths so the

808
00:32:34,529 --> 00:32:32,620
cameras on dawn

809
00:32:37,230 --> 00:32:34,539
are called the framing cameras and

810
00:32:41,509 --> 00:32:37,240
they're provided to us from DLR and Max

811
00:32:45,330 --> 00:32:41,519
Planck in Germany and I don't know like

812
00:32:47,999 --> 00:32:45,340
specifics of how the optics compare but

813
00:32:50,310 --> 00:32:48,009

I know that we will have some gorgeous

814
00:32:52,259 --> 00:32:50,320
images coming out of them what

815
00:32:54,090 --> 00:32:52,269
wavelength divided visible light or the

816
00:32:58,560 --> 00:32:54,100
infrared what wavelength ranges do we do

817
00:33:00,210 --> 00:32:58,570
you have there so we have a filter wheel

818
00:33:02,009 --> 00:33:00,220
in front of it so we can pick a couple

819
00:33:03,930 --> 00:33:02,019
different filters so we have some kind

820
00:33:07,169 --> 00:33:03,940
of indivisible range and some of the

821
00:33:09,810 --> 00:33:07,179
near-infrared colors and then we also

822
00:33:11,759 --> 00:33:09,820
have a visible and infrared spectrometer

823
00:33:13,769 --> 00:33:11,769
that can get more than infrared data and

824
00:33:15,150 --> 00:33:13,779
then we also have a gamma ray and

825
00:33:17,790 --> 00:33:15,160
neutron detector or gray

826
00:33:21,690 --> 00:33:17,800
and that'll be able to see kind of in

827
00:33:22,710 --> 00:33:21,700
the gamma ray Neutron range so we we can

828
00:33:24,510 --> 00:33:22,720
basically see a whole bunch of different

829
00:33:26,790 --> 00:33:24,520
wavelengths of light with our different

830
00:33:27,930 --> 00:33:26,800
instruments okay that sounds so and

831
00:33:30,660 --> 00:33:27,940
these are relative and because of the

832
00:33:31,910 --> 00:33:30,670
proximity of dawn to series you'll be

833
00:33:35,010 --> 00:33:31,920
able to get a lot of high resolution

834
00:33:36,360 --> 00:33:35,020
images from that I have and we get back

835
00:33:39,870 --> 00:33:36,370
to the Q&A app we've got a couple of

836
00:33:43,170 --> 00:33:39,880
good things here Erik sharland is asking

837
00:33:45,810 --> 00:33:43,180
what does series miss to be qualified as

838
00:33:48,840 --> 00:33:45,820

a dwarf planet I think it is a dwarf

839
00:33:50,820 --> 00:33:48,850
planet isn't it John yay

840
00:33:53,700 --> 00:33:50,830
yeah Ceres is a dwarf oh yeah so I think

841
00:33:54,840 --> 00:33:53,710
it is one that doesn't miss it is it is

842
00:33:57,500 --> 00:33:54,850
a dwarf planet but thanks for asking

843
00:34:00,630 --> 00:33:57,510
that Erik and so maybe he's asking

844
00:34:06,480 --> 00:34:00,640
missing to not be classified as a true

845
00:34:09,960 --> 00:34:06,490
planet oh because Mike Brown's out there

846
00:34:11,280 --> 00:34:09,970
just killing all sorts of things killing

847
00:34:12,930 --> 00:34:11,290
off that's right he's killing all kind

848
00:34:15,950 --> 00:34:12,940
of plans let's talk about that just

849
00:34:19,139 --> 00:34:15,960
briefly I don't know if John yang or or

850
00:34:21,720 --> 00:34:19,149
Kerry if you want to take this but what

851
00:34:24,930 --> 00:34:21,730
is the link what is the limit what's

852
00:34:26,879 --> 00:34:24,940
what's the limit what's the deciding

853
00:34:35,369 --> 00:34:26,889
factor on whether it's a planet as a

854
00:34:37,680 --> 00:34:35,379
planet or a dwarf body okay um so so

855
00:34:40,560 --> 00:34:37,690
basically to qualify to be a planet I

856
00:34:44,070 --> 00:34:40,570
think there there are three criteria one

857
00:34:47,280 --> 00:34:44,080
is that it has to be circled in a song

858
00:34:49,680 --> 00:34:47,290
that's easy and second is that it has to

859
00:34:52,919 --> 00:34:49,690
be it has to be big enough to maintain

860
00:34:55,320 --> 00:34:52,929
around it in round shape that's not very

861
00:34:58,560 --> 00:34:55,330
easy but series made it and then the

862
00:35:00,450 --> 00:34:58,570
third one is that you have to clear your

863
00:35:03,750 --> 00:35:00,460

neighborhood which means that you don't

864
00:35:06,300 --> 00:35:03,760
have any small you know many more chunks

865
00:35:09,210 --> 00:35:06,310
around you you know circling the Sun in

866
00:35:11,790 --> 00:35:09,220
in orbit very close to you so that's the

867
00:35:13,440 --> 00:35:11,800
three criteria and if you if you only

868
00:35:14,850 --> 00:35:13,450
satisfy the first two and not the last

869
00:35:16,890 --> 00:35:14,860
one then you are a dwarf planet

870
00:35:19,260 --> 00:35:16,900
well there's another one I think like

871
00:35:23,280 --> 00:35:19,270
Scott said Mike Brown has to approve but

872
00:35:26,520 --> 00:35:23,290
um okay so here's a good question from

873
00:35:28,320 --> 00:35:26,530
Albert Bundy is the maybe this was also

874
00:35:30,840 --> 00:35:28,330
for you Tanya I'm not

875
00:35:33,780 --> 00:35:30,850
or is the gravity of Ceres enough to

876
00:35:36,120 --> 00:35:33,790
attract more surrounding rock and able

877
00:35:38,070 --> 00:35:36,130
to grow in size and mass I think one of

878
00:35:42,090 --> 00:35:38,080
the criterion you just mentioned kind of

879
00:35:46,470 --> 00:35:42,100
answers that question but what is it

880
00:35:49,020 --> 00:35:46,480
even more stuff well the the you know if

881
00:35:52,430 --> 00:35:49,030
you if you have a if you want see how do

882
00:35:55,860 --> 00:35:52,440
you answer that okay if you have enough

883
00:35:57,720 --> 00:35:55,870
then you know depending on if any I'll

884
00:35:59,760 --> 00:35:57,730
depending on the you know how much how

885
00:36:01,950 --> 00:35:59,770
much material around you you're either

886
00:36:04,440 --> 00:36:01,960
grab them and grow yourself or you know

887
00:36:05,430 --> 00:36:04,450
kick them out you know at the early

888
00:36:07,650 --> 00:36:05,440

stage when you have enough material

889
00:36:09,420 --> 00:36:07,660
surrounding you then mostly you're

890
00:36:11,940 --> 00:36:09,430
you're gonna grow you're gonna you know

891
00:36:14,070 --> 00:36:11,950
attract more material and creat more

892
00:36:16,410 --> 00:36:14,080
material and you grow yourself but then

893
00:36:18,090 --> 00:36:16,420
when there's no much material around you

894
00:36:19,770 --> 00:36:18,100
and then when they're the relative

895
00:36:22,860 --> 00:36:19,780
velocity between you and your you know

896
00:36:25,320 --> 00:36:22,870
those small junks around you or high

897
00:36:27,930 --> 00:36:25,330
enough then what you do is that you you

898
00:36:29,310 --> 00:36:27,940
actually eject those objects you can't

899
00:36:33,690 --> 00:36:29,320
read out them you know you threw them

900
00:36:36,030 --> 00:36:33,700
out and so so the third criteria that

901
00:36:38,250 --> 00:36:36,040
you clear out the the parties around you

902
00:36:40,410 --> 00:36:38,260
that's actually nice to actually talk

903
00:36:42,630 --> 00:36:40,420
about talks about you know the last

904
00:36:45,390 --> 00:36:42,640
stage when you actually eject those

905
00:36:48,450 --> 00:36:45,400
chunks away from you and the massive

906
00:36:51,210 --> 00:36:48,460
series is not big enough to to to eject

907
00:36:55,680 --> 00:36:51,220
enough material around it to clear its

908
00:36:56,220 --> 00:36:55,690
orbit so although it's much messier than

909
00:36:57,870 --> 00:36:56,230
others

910
00:36:59,880 --> 00:36:57,880
other asteroids is still still not

911
00:37:01,080 --> 00:36:59,890
massive enough to do that job good

912
00:37:02,550 --> 00:37:01,090
question Albert that was that was really

913
00:37:04,770 --> 00:37:02,560

relevant for we were just then talking

914
00:37:06,990 --> 00:37:04,780
about so that's really though there can

915
00:37:09,570 --> 00:37:07,000
still be fresh craters on Ceres when Don

916
00:37:11,760 --> 00:37:09,580
gets there because not because series

917
00:37:13,220 --> 00:37:11,770
gravitationally pulled anything in under

918
00:37:15,750 --> 00:37:13,230
the surface but you know there's

919
00:37:17,100 --> 00:37:15,760
collisions most of the collisions happen

920
00:37:18,570 --> 00:37:17,110
in the early solar system but there are

921
00:37:20,280 --> 00:37:18,580
still the possibility that smaller

922
00:37:22,380 --> 00:37:20,290
asteroids could crash you know just

923
00:37:23,370 --> 00:37:22,390
crash into the surface of Ceres again

924
00:37:26,370 --> 00:37:23,380
not because it's being gravitationally

925
00:37:28,340 --> 00:37:26,380
pulled in just a simple collision we see

926
00:37:30,870 --> 00:37:28,350
other collisions of asteroids going on

927
00:37:32,550 --> 00:37:30,880
it's rare because the asteroid belt is

928
00:37:41,160 --> 00:37:32,560
much emptier than most people think it

929
00:37:42,240 --> 00:37:41,170
is we do know that there are still

930
00:37:43,830 --> 00:37:42,250
collisions you know

931
00:37:45,360 --> 00:37:43,840
currently happening and there's pretty

932
00:37:48,510 --> 00:37:45,370
good reason to expect that there will be

933
00:37:51,540 --> 00:37:48,520
relatively fresh craters on Ceres yeah

934
00:37:54,950 --> 00:37:51,550
so so Kerry I want to ask you a quick

935
00:37:57,330 --> 00:37:54,960
question about the specifics of the

936
00:38:00,000 --> 00:37:57,340
science goals of dawn with respect to

937
00:38:03,000 --> 00:38:00,010
Ceres what can you give us some specific

938
00:38:10,530 --> 00:38:03,010

things you're hoping to do and learn on

939
00:38:16,350 --> 00:38:10,540
this visit hello hello

940
00:38:20,310 --> 00:38:16,360
they look frozen eyes okay you froze but

941
00:38:23,880 --> 00:38:20,320
maybe you froze in relation to us did

942
00:38:26,520 --> 00:38:23,890
you hear my question yeah really I was

943
00:38:27,840 --> 00:38:26,530
asking about the science goals of dawn

944
00:38:29,340 --> 00:38:27,850
can you give us some overview of some

945
00:38:32,130 --> 00:38:29,350
specific science goals that you're

946
00:38:37,350 --> 00:38:32,140
hoping to achieve when you reach series

947
00:38:39,780 --> 00:38:37,360
so yeah so kind of relating to dig on as

948
00:38:42,300 --> 00:38:39,790
a detective we're going there and we

949
00:38:44,100 --> 00:38:42,310
want to map the entire surface and we

950
00:38:46,530 --> 00:38:44,110
want to get good pictures of the entire

951
00:38:48,450 --> 00:38:46,540
surface and kind of make a map and with

952
00:38:50,580 --> 00:38:48,460
that you can get the topography you can

953
00:38:52,260 --> 00:38:50,590
get the geology and the geologic units

954
00:38:54,030 --> 00:38:52,270
which is basically the type of rocks

955
00:38:56,400 --> 00:38:54,040
that are similar and you kind of group

956
00:38:58,680 --> 00:38:56,410
them together and you can actually see

957
00:39:02,460 --> 00:38:58,690
on dawn Dawn's website right now dawn

958
00:39:06,720 --> 00:39:02,470
JPL NASA gov we have a link to the Vesta

959
00:39:09,540 --> 00:39:06,730
geologic maps and so well also with the

960
00:39:11,640 --> 00:39:09,550
other instruments we'll be able to get

961
00:39:14,250 --> 00:39:11,650
mineralogical information and also

962
00:39:15,630 --> 00:39:14,260
elemental composition and given all of

963
00:39:19,290 --> 00:39:15,640

those things it will give us the big

964
00:39:22,500 --> 00:39:19,300
picture oh yes so this is a globe of

965
00:39:24,390 --> 00:39:22,510
what this is the topography of Vesta so

966
00:39:25,590 --> 00:39:24,400
Vesta isn't round so this kind of had to

967
00:39:27,810 --> 00:39:25,600
be squished to make it into a round

968
00:39:30,690 --> 00:39:27,820
shape but we'll be able to have

969
00:39:32,850 --> 00:39:30,700
something like this for series two okay

970
00:39:34,380 --> 00:39:32,860
I'm taking this home with me totally

971
00:39:37,080 --> 00:39:34,390
taking this home with me Scott you're

972
00:39:39,180 --> 00:39:37,090
just gonna rip all this off it's great I

973
00:39:42,540 --> 00:39:39,190
know I know you're gonna be like taking

974
00:39:44,010 --> 00:39:42,550
all that stuff away so so see so Morgan

975
00:39:46,110 --> 00:39:44,020
is asking on the QA app and then I'm

976
00:39:50,010 --> 00:39:46,120
gonna go to the YouTube comments and see

977
00:39:52,170 --> 00:39:50,020
if I can find anything there will let me

978
00:39:54,570 --> 00:39:52,180
see here will series be closer to app

979
00:39:55,559 --> 00:39:54,580
Hylian or perihelion when Dawn arrives

980
00:39:58,079 --> 00:39:55,569
and

981
00:40:02,370 --> 00:39:58,089
it monitor changes in series over a full

982
00:40:04,680 --> 00:40:02,380
orbit Kerry so when we get to series

983
00:40:06,329 --> 00:40:04,690
it's moving away from the Sun and will

984
00:40:09,180 --> 00:40:06,339
be moving away from the Sun for the rest

985
00:40:11,519 --> 00:40:09,190
of the mission and so that also ties

986
00:40:13,949 --> 00:40:11,529
into that water vapor paper because they

987
00:40:15,689 --> 00:40:13,959
found a strong dependence on distance

988
00:40:17,249 --> 00:40:15,699

from the Sun and the closer they were to

989
00:40:19,170 --> 00:40:17,259
the Sun they saw the water vapor and the

990
00:40:20,819 --> 00:40:19,180
further they were away they didn't see

991
00:40:24,180 --> 00:40:20,829
it that was the personal observations

992
00:40:27,029 --> 00:40:24,190
right yeah yes when we're getting to

993
00:40:29,699 --> 00:40:27,039
Ceres it's past that point already and

994
00:40:32,249 --> 00:40:29,709
it's only going further away so it'll be

995
00:40:34,739 --> 00:40:32,259
very interesting to see if we see it and

996
00:40:40,559 --> 00:40:34,749
we don't know if we will or not but

997
00:40:44,489 --> 00:40:40,569
we're definitely gonna look for it so by

998
00:40:46,680 --> 00:40:44,499
all means yeah so Herschel Herschel hojo

999
00:40:48,599 --> 00:40:46,690
observed the the water vapor around

1000
00:40:52,829 --> 00:40:48,609
Ceres but right now there's only one

1001
00:40:54,509 --> 00:40:52,839
child appellation so one one people were

1002
00:40:56,249 --> 00:40:54,519
thinking what what what could be the

1003
00:40:58,859 --> 00:40:56,259
possible reason for that sublimation and

1004
00:41:00,180 --> 00:40:58,869
one reason is like comment you know when

1005
00:41:01,979 --> 00:41:00,190
they get close to the sound they

1006
00:41:04,079 --> 00:41:01,989
sublimate when they get away they don't

1007
00:41:06,180 --> 00:41:04,089
sublimate and if this is the case for

1008
00:41:08,309 --> 00:41:06,190
series then you know by the time that

1009
00:41:09,839 --> 00:41:08,319
Tonga series and around series and

1010
00:41:12,420 --> 00:41:09,849
series is quite powerful far away from

1011
00:41:15,239 --> 00:41:12,430
the Sun actually it's near its scaling

1012
00:41:17,999 --> 00:41:15,249
is going to it's it's appealing so in

1013
00:41:20,039 --> 00:41:18,009

that case we may not expect much water

1014
00:41:21,660 --> 00:41:20,049
vapor around Ceres however there are

1015
00:41:23,579 --> 00:41:21,670
other scenarios that can make water

1016
00:41:27,180 --> 00:41:23,589
vapor like you know like what's

1017
00:41:30,089 --> 00:41:27,190
happening for what what's happening for

1018
00:41:32,609 --> 00:41:30,099
like organism if it's if if there's some

1019
00:41:35,279 --> 00:41:32,619
kind of internal heating you know then

1020
00:41:36,779 --> 00:41:35,289
that drives out water then since this is

1021
00:41:39,120 --> 00:41:36,789
the internal heating it does not depend

1022
00:41:42,150 --> 00:41:39,130
on water depending on does not depend on

1023
00:41:44,910 --> 00:41:42,160
solar heating a lot so this will have

1024
00:41:47,339 --> 00:41:44,920
weak dependence on a distance of series

1025
00:41:48,719 --> 00:41:47,349
with with the Sun so if this is the case

1026
00:41:50,939 --> 00:41:48,729
then we might be able to see something

1027
00:41:53,160 --> 00:41:50,949
so that's why you know there's a

1028
00:41:55,799 --> 00:41:53,170
actually tone has another you know right

1029
00:41:59,189 --> 00:41:55,809
now this also are also one of Don's

1030
00:42:01,739 --> 00:41:59,199
tasks try to see what it what water in

1031
00:42:04,079 --> 00:42:01,749
series is really like and how much water

1032
00:42:07,349 --> 00:42:04,089
does it have really forty percent or we

1033
00:42:09,570 --> 00:42:07,359
are wrong before and also where are this

1034
00:42:11,910 --> 00:42:09,580
water you know are they very deep

1035
00:42:13,350 --> 00:42:11,920
inside the surface inside the curio or

1036
00:42:16,170 --> 00:42:13,360
they are very close to the surface and

1037
00:42:18,900 --> 00:42:16,180
also what kind of activity are there so

1038
00:42:20,760 --> 00:42:18,910

by observing you know water whether

1039
00:42:22,280 --> 00:42:20,770
there's any ice on the surface or you

1040
00:42:24,360 --> 00:42:22,290
know very shallow beneath the surface

1041
00:42:26,760 --> 00:42:24,370
we're actually trying to answer this

1042
00:42:28,410 --> 00:42:26,770
question - great man you guys are asking

1043
00:42:30,870 --> 00:42:28,420
some great questions I'm just gonna keep

1044
00:42:34,950 --> 00:42:30,880
going here I like this one

1045
00:42:38,430 --> 00:42:34,960
Jorge Lima on Q&A app is asking hi

1046
00:42:41,070 --> 00:42:38,440
Rosetta analysis on the comet 67p water

1047
00:42:44,010 --> 00:42:41,080
showed that it's different than the

1048
00:42:46,650 --> 00:42:44,020
water on earth I did not know that will

1049
00:42:51,570 --> 00:42:46,660
dawn also makes a similar analysis on

1050
00:42:55,170 --> 00:42:51,580
Ceres water that is a good question

1051
00:42:57,660 --> 00:42:55,180
so our grand instrument does elemental

1052
00:43:00,200 --> 00:42:57,670
composition but it can only see a little

1053
00:43:03,300 --> 00:43:00,210
bit into the surface so if this water is

1054
00:43:07,770 --> 00:43:03,310
too low below the surface it's not going

1055
00:43:09,120 --> 00:43:07,780
to be able to see the water so it's

1056
00:43:11,880 --> 00:43:09,130
really going to depend on close the

1057
00:43:14,640 --> 00:43:11,890
water is to the surface and the ability

1058
00:43:16,260 --> 00:43:14,650
of our instruments to see it okay so the

1059
00:43:18,900 --> 00:43:16,270
good question that is interesting so

1060
00:43:20,850 --> 00:43:18,910
would then I think it's what van der

1061
00:43:23,520 --> 00:43:20,860
Heide I'm sorry if I'm messing up the

1062
00:43:25,410 --> 00:43:23,530
pronunciation this is also Q&A app and

1063
00:43:27,120 --> 00:43:25,420

this is I guess it's timely since we've

1064
00:43:30,870 --> 00:43:27,130
talked about this for most of the hour

1065
00:43:33,270 --> 00:43:30,880
how will the NASA dawn mission end after

1066
00:43:36,270 --> 00:43:33,280
studying Siri series will the probe just

1067
00:43:38,160 --> 00:43:36,280
send will just be sent in a trajectory

1068
00:43:40,920 --> 00:43:38,170
outside our solar system will it keep

1069
00:43:42,900 --> 00:43:40,930
orbiting series or can we can we try a

1070
00:43:45,960 --> 00:43:42,910
soft landing on Ceres like the one

1071
00:43:48,780 --> 00:43:45,970
that's being considered with Rosetta so

1072
00:43:50,490 --> 00:43:48,790
the plan with Don at the end is that we

1073
00:43:53,910 --> 00:43:50,500
will stay on our lowest orbit the low

1074
00:43:55,560 --> 00:43:53,920
altitude mapping orbit for cover and the

1075
00:43:57,710 --> 00:43:55,570
reason that we don't want to touch Ceres

1076
00:43:59,940 --> 00:43:57,720
is because of all of that water and

1077
00:44:01,410 --> 00:43:59,950
there's this thing called planetary

1078
00:44:03,390 --> 00:44:01,420
protection that we don't want to

1079
00:44:07,650 --> 00:44:03,400
interfere and touch any water

1080
00:44:10,830 --> 00:44:07,660
I'm directive yes basically so we want

1081
00:44:12,810 --> 00:44:10,840
to basically stay safe and stay in our

1082
00:44:15,720 --> 00:44:12,820
orbit and just kind of orbit series so

1083
00:44:19,530 --> 00:44:15,730
via a lonely moon orbiting series

1084
00:44:22,620 --> 00:44:19,540
forever that's kind of a nice image

1085
00:44:23,340 --> 00:44:22,630
though but you know sorry Tony one thing

1086
00:44:25,290 --> 00:44:23,350
I learned a while

1087
00:44:27,630 --> 00:44:25,300
which I was surprised to hear is that

1088
00:44:29,970 --> 00:44:27,640

apparently early on there was a chance

1089
00:44:32,610 --> 00:44:29,980
that Don could go to the large asteroid

1090
00:44:34,740 --> 00:44:32,620
Pallas after series but I guess because

1091
00:44:37,200 --> 00:44:34,750
of launch delays that that opportunity

1092
00:44:39,840 --> 00:44:37,210
was lost and so I just it's

1093
00:44:42,120 --> 00:44:39,850
heartbreaking you know to hear that but

1094
00:44:43,620 --> 00:44:42,130
it does make you realize as Kerry was

1095
00:44:45,150 --> 00:44:43,630
describing at the beginning you know

1096
00:44:47,190 --> 00:44:45,160
that I guess there's always you know

1097
00:44:49,770 --> 00:44:47,200
even if you stay in sort of a stable

1098
00:44:51,240 --> 00:44:49,780
orbit for even a decade you know is

1099
00:44:53,910 --> 00:44:51,250
there a possibility that if there's

1100
00:44:55,530 --> 00:44:53,920
funding and an object to go to that you

1101
00:44:57,300 --> 00:44:55,540
could you know flip the switches back on

1102
00:44:59,190 --> 00:44:57,310
and say okay we're leaving Ceres orbit

1103
00:45:00,420 --> 00:44:59,200
and going to another object or is it

1104
00:45:05,010 --> 00:45:00,430
just that there's no really interesting

1105
00:45:07,260 --> 00:45:05,020
objects you know within reach yet I

1106
00:45:09,240 --> 00:45:07,270
don't know yet another advantage of on

1107
00:45:10,530 --> 00:45:09,250
Drive is that possible carry can can

1108
00:45:16,920 --> 00:45:10,540
they just do that if they decide there's

1109
00:45:18,420 --> 00:45:16,930
something else to look at do you know we

1110
00:45:19,860 --> 00:45:18,430
didn't catch that that all head out for

1111
00:45:22,050 --> 00:45:19,870
a second molar sorry is that is that

1112
00:45:23,520 --> 00:45:22,060
true that that you know you can maybe

1113
00:45:24,660 --> 00:45:23,530

just after if you see something else

1114
00:45:27,240 --> 00:45:24,670
interesting you can just turn on the

1115
00:45:29,700 --> 00:45:27,250
drives and it still does it remain

1116
00:45:35,640 --> 00:45:29,710
possible to depart series ever in the

1117
00:45:37,980 --> 00:45:35,650
future yeah that's a good play the

1118
00:45:41,190 --> 00:45:37,990
reason that we will not depart series is

1119
00:45:44,880 --> 00:45:41,200
because we had two of our four reaction

1120
00:45:47,130 --> 00:45:44,890
wheel almost fail and so to turn we have

1121
00:45:49,560 --> 00:45:47,140
to use also our hydrazine thrusters in

1122
00:45:53,280 --> 00:45:49,570
addition to our reaction wheels and so

1123
00:45:55,230 --> 00:45:53,290
for us to stay there we're really gonna

1124
00:45:56,790 --> 00:45:55,240
we wanted to make sure we got serious

1125
00:45:59,100 --> 00:45:56,800
done and that's basically going to use

1126
00:46:00,510 --> 00:45:59,110
up the rest of our resources so we won't

1127
00:46:03,300 --> 00:46:00,520
be able to turn anymore and if we can't

1128
00:46:04,950 --> 00:46:03,310
turn then we can't turn to send all of

1129
00:46:07,020 --> 00:46:04,960
those pictures back and we can't turn to

1130
00:46:09,810 --> 00:46:07,030
take the pictures I swear reaction

1131
00:46:12,120 --> 00:46:09,820
wheels and awesome missions are just

1132
00:46:14,130 --> 00:46:12,130
going hand-in-hand with not going well

1133
00:46:16,050 --> 00:46:14,140
we need to find a better I know these

1134
00:46:18,540 --> 00:46:16,060
these reaction we all seem to be there

1135
00:46:20,910 --> 00:46:18,550
with Achilles heel of most most missions

1136
00:46:22,470 --> 00:46:20,920
these days but that is a neat idea max

1137
00:46:26,100 --> 00:46:22,480
that would be cool if they could if they

1138
00:46:27,480 --> 00:46:26,110

could do that okay so finally let me

1139
00:46:32,190 --> 00:46:27,490
just okay I'm gonna go over here and

1140
00:46:33,990 --> 00:46:32,200
look at my youtube okay so we just

1141
00:46:36,790 --> 00:46:34,000
here's one from Enrico Gatto from

1142
00:46:39,430 --> 00:46:36,800
YouTube I'll just put this up real quick

1143
00:46:41,710 --> 00:46:39,440
is dawn going to visit any other body of

1144
00:46:43,420 --> 00:46:41,720
the solar system after series Kerry just

1145
00:46:50,020 --> 00:46:43,430
answered that sounds like we're it's not

1146
00:46:52,720 --> 00:46:50,030
going to go anywhere so and let me see

1147
00:46:55,720 --> 00:46:52,730
cage crave on YouTube can you point your

1148
00:46:59,380 --> 00:46:55,730
telescope on our binary Dark Star

1149
00:47:01,960 --> 00:46:59,390
companion I don't know what that the

1150
00:47:03,790 --> 00:47:01,970
darks Arkham yeah yeah that's like with

1151
00:47:05,920 --> 00:47:03,800
the red matter from Star Trek and I

1152
00:47:09,930 --> 00:47:05,930
think we can just go along okay okay

1153
00:47:15,550 --> 00:47:09,940
yeah yeah so there we go okay so that's

1154
00:47:16,870 --> 00:47:15,560
yeah thank you YouTube sorry this is

1155
00:47:20,440 --> 00:47:16,880
what I get for not having a director

1156
00:47:21,850 --> 00:47:20,450
write down today so okay so I think that

1157
00:47:24,280 --> 00:47:21,860
do I have any is there anything from

1158
00:47:26,350 --> 00:47:24,290
Twitter Scott that I'm missing oh I've

1159
00:47:27,940 --> 00:47:26,360
been trying to monitor Twitter there's

1160
00:47:31,570 --> 00:47:27,950
been a lot going on first of all I do

1161
00:47:34,330 --> 00:47:31,580
want to give a shout out to the the the

1162
00:47:37,240 --> 00:47:34,340
dawn EP team they've been great with

1163
00:47:39,280 --> 00:47:37,250

with tweeting out as everything's going

1164
00:47:42,250 --> 00:47:39,290
on and interacting with everyone there

1165
00:47:44,830 --> 00:47:42,260
but people are having just some great

1166
00:47:47,410 --> 00:47:44,840
conversations about the amazing images

1167
00:47:49,840 --> 00:47:47,420
that have been going on and sharing out

1168
00:47:52,900 --> 00:47:49,850
our show so we really love that and all

1169
00:47:54,490 --> 00:47:52,910
the great great tweets and the love of

1170
00:47:56,790 --> 00:47:54,500
the images that we've been sending out

1171
00:47:58,990 --> 00:47:56,800
to so I've been tweeting out as as

1172
00:48:00,340 --> 00:47:59,000
Hubble of the different images we're

1173
00:48:02,020 --> 00:48:00,350
going out there so there's been a lot of

1174
00:48:03,850 --> 00:48:02,030
great stuff I'm gonna head over to the

1175
00:48:05,650 --> 00:48:03,860
event page and see what else we have

1176
00:48:06,550 --> 00:48:05,660
going on the event page okay yeah check

1177
00:48:08,200 --> 00:48:06,560
it out and let me know if you see

1178
00:48:11,140 --> 00:48:08,210
anything max I'd like to ask you a quick

1179
00:48:14,350 --> 00:48:11,150
question about is there any future role

1180
00:48:18,010 --> 00:48:14,360
or any plans with Hubble that you know

1181
00:48:19,900 --> 00:48:18,020
of - maybe observe series in conjunction

1182
00:48:22,210 --> 00:48:19,910
with dawn or is Hubble pretty much done

1183
00:48:25,120 --> 00:48:22,220
for now with its with its participation

1184
00:48:26,860 --> 00:48:25,130
do you happen to know well you know

1185
00:48:30,130 --> 00:48:26,870
there is some data that we're working on

1186
00:48:32,650 --> 00:48:30,140
right now I mean you know there's been

1187
00:48:34,330 --> 00:48:32,660
some observations last spring and one of

1188
00:48:36,580 --> 00:48:34,340

the things we've done for dawn for both

1189
00:48:39,010 --> 00:48:36,590
Vesta and Ceres a search for moons and

1190
00:48:40,570 --> 00:48:39,020
we're still working on that I think are

1191
00:48:41,950 --> 00:48:40,580
but you know of course now the dawn

1192
00:48:43,480 --> 00:48:41,960
spacecraft is going to be able to do

1193
00:48:44,910 --> 00:48:43,490
that even better so but it's all you

1194
00:48:46,660 --> 00:48:44,920
know the same people who've been using

1195
00:48:49,180 --> 00:48:46,670
Hubble and now I think we're

1196
00:48:50,680 --> 00:48:49,190
transitioning to a moon search with the

1197
00:48:54,370 --> 00:48:50,690
dawn spacecraft does it a pro

1198
00:48:57,280 --> 00:48:54,380
so just before it goes into orbit early

1199
00:49:00,070 --> 00:48:57,290
next year and so we're still you know

1200
00:49:01,540 --> 00:49:00,080
still working on that problem you know

1201
00:49:03,340 --> 00:49:01,550
we've done many searches so I think if

1202
00:49:05,110 --> 00:49:03,350
series had a big moon we'd know it by

1203
00:49:07,300 --> 00:49:05,120
now you know right we're kind of like

1204
00:49:08,610 --> 00:49:07,310
scratching in the dirt now to try to see

1205
00:49:14,290 --> 00:49:08,620
if there could be a small satellite

1206
00:49:16,210 --> 00:49:14,300
around Ceres so and I think depending on

1207
00:49:19,120 --> 00:49:16,220
what happens you know I know with

1208
00:49:22,320 --> 00:49:19,130
discoveries of dönitz series there could

1209
00:49:24,370 --> 00:49:22,330
be some kind of follow-up or some

1210
00:49:26,500 --> 00:49:24,380
complementary observations that could be

1211
00:49:28,180 --> 00:49:26,510
done with Hubble possibly I think it

1212
00:49:41,460 --> 00:49:28,190
remains to be seen but it would be

1213
00:49:47,560 --> 00:49:44,290

right I believe Jane that you'll be

1214
00:49:51,370 --> 00:49:47,570
still observing series from Hubble quite

1215
00:49:54,700 --> 00:49:51,380
a long time right well we actually have

1216
00:49:56,920 --> 00:49:54,710
another observation from both one series

1217
00:50:00,160 --> 00:49:56,930
which will be next year yeah next year

1218
00:50:02,710 --> 00:50:00,170
in June and that is actually in a UV

1219
00:50:04,450 --> 00:50:02,720
because you know Tom does not don't mean

1220
00:50:06,250 --> 00:50:04,460
Tony instrument is not sensitive to UV

1221
00:50:08,560 --> 00:50:06,260
wavelength which is you know do we work

1222
00:50:12,340 --> 00:50:08,570
with UV is what with everybody doesn't

1223
00:50:15,670 --> 00:50:12,350
like and so you cannot do that from one

1224
00:50:18,190 --> 00:50:15,680
everybody just like yeah yeah because

1225
00:50:25,480 --> 00:50:18,200
everybody use some blockers to block it

1226
00:50:27,910 --> 00:50:25,490
oh you want see anything in the UV from

1227
00:50:30,490 --> 00:50:27,920
a space telescope couples the only game

1228
00:50:32,080 --> 00:50:30,500
in town there's the only actually

1229
00:50:34,060 --> 00:50:32,090
actually you cannot do that from the

1230
00:50:35,650 --> 00:50:34,070
ground just because our atmosphere

1231
00:50:38,100 --> 00:50:35,660
actually blocks a lot of beauty already

1232
00:50:41,950 --> 00:50:38,110
so we cannot do that on the ground and

1233
00:50:44,760 --> 00:50:41,960
instrument yeah and so that's why we're

1234
00:50:47,110 --> 00:50:44,770
good there's a good question from

1235
00:50:50,050 --> 00:50:47,120
there's a good question here from the

1236
00:50:52,180 --> 00:50:50,060
Google+ event page which might cause a

1237
00:50:55,720 --> 00:50:52,190
minor fight to break out here at Jet

1238
00:50:57,580 --> 00:50:55,730

Propulsion Laboratory is if significant

1239
00:50:59,890 --> 00:50:57,590
water is detected on Ceres with that

1240
00:51:03,100 --> 00:50:59,900
minor planet or planet become as

1241
00:51:04,270 --> 00:51:03,110
important as Mars is now for NASA in the

1242
00:51:07,240 --> 00:51:04,280
future

1243
00:51:10,150 --> 00:51:07,250
I'm sure that could cause a fight here

1244
00:51:11,500 --> 00:51:10,160
on these grounds but I'm not sure to

1245
00:51:12,940 --> 00:51:11,510
hear what you have to say about that

1246
00:51:15,880 --> 00:51:12,950
then I'll talk with our Marsh friends

1247
00:51:18,490 --> 00:51:15,890
afterwards so we're not in competition

1248
00:51:23,040 --> 00:51:18,500
we're all one big happy family here at

1249
00:51:26,950 --> 00:51:23,050
NASA and so you know it's really up to

1250
00:51:29,020 --> 00:51:26,960
the scientists and Congress to identify

1251
00:51:31,510 --> 00:51:29,030
the priorities and come up with the

1252
00:51:33,130 --> 00:51:31,520
budget for it and and that's one thing

1253
00:51:35,200 --> 00:51:33,140
that's always great to do is rely on

1254
00:51:38,490 --> 00:51:35,210
Congress to make great decisions for

1255
00:51:41,080 --> 00:51:38,500
it's for science quickly that's right I

1256
00:51:43,060 --> 00:51:41,090
just want to say the opinions expressed

1257
00:51:48,849 --> 00:51:43,070
by Scott Lewis are his own and I have an

1258
00:51:50,200 --> 00:51:48,859
independent contractor all right this

1259
00:51:51,880 --> 00:51:50,210
has been awesome well I will say one

1260
00:51:53,170 --> 00:51:51,890
thing we've had a lot of live viewers on

1261
00:51:55,450 --> 00:51:53,180
this hangout it's been really great

1262
00:51:57,130 --> 00:51:55,460
having you guys there I'm still oh

1263
00:51:57,730 --> 00:51:57,140

here's one from zigzag them you get to

1264
00:52:00,040 --> 00:51:57,740
that real quick

1265
00:52:02,680 --> 00:52:00,050
does series have a gravity and

1266
00:52:04,630 --> 00:52:02,690
atmosphere also any indications of ice

1267
00:52:07,270 --> 00:52:04,640
on the surface gas emissions coming from

1268
00:52:09,520 --> 00:52:07,280
Ceres we've answered some of that that

1269
00:52:11,680 --> 00:52:09,530
does have gravity you can be sure of

1270
00:52:14,230 --> 00:52:11,690
that and Kerry mentioned something about

1271
00:52:15,970 --> 00:52:14,240
atmospheres and is there any indications

1272
00:52:20,530 --> 00:52:15,980
of ice on the surface are we sure of any

1273
00:52:23,800 --> 00:52:20,540
ice on the surface guys no okay now yeah

1274
00:52:25,480 --> 00:52:23,810
well maybe not yet right no exactly we

1275
00:52:27,010 --> 00:52:25,490
get those pictures from from dawn to

1276
00:52:35,440 --> 00:52:27,020
find that out and as far as we know no

1277
00:52:37,089 --> 00:52:35,450
gas emissions show that there there

1278
00:52:39,579 --> 00:52:37,099
might be some water vapor I mean they

1279
00:52:42,670 --> 00:52:39,589
are some water vapor entities but very

1280
00:52:45,370 --> 00:52:42,680
very moment so there you go good

1281
00:52:50,589 --> 00:52:45,380
question zigzag thank you very much okay

1282
00:52:52,210 --> 00:52:50,599
so let's see I guess some I I'm trying

1283
00:52:54,550 --> 00:52:52,220
to see if I'm missing anything Scott can

1284
00:52:56,710 --> 00:52:54,560
you tell me one more time if you see

1285
00:52:58,870 --> 00:52:56,720
anything now I think we've got them on

1286
00:53:00,670 --> 00:52:58,880
we we don't a few things to mention as

1287
00:53:03,670 --> 00:53:00,680
far as you know since this is our first

1288
00:53:07,060 --> 00:53:03,680

really big which I'm really happy to be

1289
00:53:09,730 --> 00:53:07,070
a part of a collaborative Hubble hang

1290
00:53:11,200 --> 00:53:09,740
out with other science missions do you

1291
00:53:13,720 --> 00:53:11,210
want to do a quick shout out again to

1292
00:53:15,970 --> 00:53:13,730
everyone at the the dawn team including

1293
00:53:17,500 --> 00:53:15,980
Kerry whom I just happen to be friends

1294
00:53:20,380 --> 00:53:17,510
with but everyone else

1295
00:53:22,900 --> 00:53:20,390
at the dawn team the science team the

1296
00:53:25,570 --> 00:53:22,910
outreach team there is an event coming

1297
00:53:28,900 --> 00:53:25,580
up on the 9th of May of next year called

1298
00:53:30,550 --> 00:53:28,910
ic series there's a link down here and

1299
00:53:34,180 --> 00:53:30,560
I'll put this into the event page but

1300
00:53:37,480 --> 00:53:34,190
it's a bitly link dawn underscored by

1301
00:53:39,040 --> 00:53:37,490
the letter C series and you can find out

1302
00:53:41,530 --> 00:53:39,050
more about what's going on that will be

1303
00:53:45,130 --> 00:53:41,540
here in Cal Tech but people can start up

1304
00:53:48,820 --> 00:53:45,140
their own private events across the

1305
00:53:51,160 --> 00:53:48,830
world and I might actually be attending

1306
00:53:53,230 --> 00:53:51,170
that too here for different reasons but

1307
00:53:56,410 --> 00:53:53,240
it's something that's there's a lot of

1308
00:53:58,420 --> 00:53:56,420
things going on with with dawn and I

1309
00:54:01,410 --> 00:53:58,430
definitely recommend going to the dawn

1310
00:54:05,470 --> 00:54:01,420
website which can be found where dawn

1311
00:54:07,150 --> 00:54:05,480
JPL nasa.gov very nicely done very well

1312
00:54:09,670 --> 00:54:07,160
done and I I just want to echo what

1313
00:54:11,380 --> 00:54:09,680

Scott said I am happy to be working with

1314
00:54:13,330 --> 00:54:11,390
other NASA missions to the extent that

1315
00:54:15,370 --> 00:54:13,340
we that Hubble is able to contribute to

1316
00:54:17,620 --> 00:54:15,380
their their science I really want to do

1317
00:54:25,650 --> 00:54:17,630
more of these Kari can we have you back

1318
00:54:31,210 --> 00:54:28,540
you froze so Kari can you do something

1319
00:54:33,760 --> 00:54:31,220
with series I think can we have her back

1320
00:54:35,560 --> 00:54:33,770
when we tell us when we get closer when

1321
00:54:40,090 --> 00:54:35,570
we get closer this early maybe sometime

1322
00:54:42,700 --> 00:54:40,100
early next year yeah and so we will have

1323
00:54:45,849 --> 00:54:42,710
we will enter our first science orbit at

1324
00:54:48,910 --> 00:54:45,859
the end of April so we will start having

1325
00:54:51,250 --> 00:54:48,920
some fantastic images at that point good

1326
00:54:52,810 --> 00:54:51,260
I hope to have you guys back and John

1327
00:54:54,400 --> 00:54:52,820
yang and max I want to thank you both

1328
00:54:55,690 --> 00:54:54,410
for giving us the Hubble contributions

1329
00:54:58,030 --> 00:54:55,700
it was really wonderful having you back

1330
00:54:59,770 --> 00:54:58,040
as always I enjoy having you in my

1331
00:55:01,560 --> 00:54:59,780
hangouts you're always really great so

1332
00:55:03,760 --> 00:55:01,570
thank you both for showing up and

1333
00:55:05,410 --> 00:55:03,770
contributing I appreciate it you hope to

1334
00:55:06,609 --> 00:55:05,420
you'll come back and join us again for

1335
00:55:10,840 --> 00:55:06,619
future ones maybe we would do some

1336
00:55:12,609 --> 00:55:10,850
common stuff who knows next week we're

1337
00:55:15,010 --> 00:55:12,619
going to have we're going to be going to

1338
00:55:16,780 --> 00:55:15,020

the intrepid museum in New York where

1339
00:55:19,150 --> 00:55:16,790
they are having the Hubble 20 double at

1340
00:55:21,160 --> 00:55:19,160
25 exhibit we'll have astronaut Mike

1341
00:55:23,080 --> 00:55:21,170
Massimino with us he will talk to us not

1342
00:55:25,660 --> 00:55:23,090
only about the exhibit but about being a

1343
00:55:27,849 --> 00:55:25,670
Space Shuttle astronaut about all the

1344
00:55:29,500 --> 00:55:27,859
experiences with Hubble he was also one

1345
00:55:30,980 --> 00:55:29,510
of the ones that worked on Hubble so he

1346
00:55:32,750 --> 00:55:30,990
can give us some

1347
00:55:35,300 --> 00:55:32,760
ground on that so that will be next week

1348
00:55:37,640 --> 00:55:35,310
at our regular time I am so excited

1349
00:55:40,820 --> 00:55:37,650
about that yeah me too

1350
00:55:42,349 --> 00:55:40,830
I when we when that was first told me

1351
00:55:45,500 --> 00:55:42,359
that we were gonna have that I kind of

1352
00:55:47,000 --> 00:55:45,510
squeeze okay I really squeezed I was

1353
00:55:49,700 --> 00:55:47,010
really excited that we'll be able to

1354
00:55:52,339 --> 00:55:49,710
talk to one of the only human beings

1355
00:55:54,020 --> 00:55:52,349
that a man in space that has worked on

1356
00:55:55,579 --> 00:55:54,030
the telescope that we get to talk about

1357
00:55:57,770 --> 00:55:55,589
every single week so it's really cool

1358
00:55:59,000 --> 00:55:57,780
yeah so as Scott mentioned I want to

1359
00:56:00,859 --> 00:55:59,010
thank everybody from the NASA Dawn

1360
00:56:02,810 --> 00:56:00,869
mission I want to thank you Carrie max

1361
00:56:03,230 --> 00:56:02,820
and John yang for for taking time out to

1362
00:56:05,000 --> 00:56:03,240
do it

1363
00:56:06,470 --> 00:56:05,010

Carol we'll be back next week she

1364
00:56:09,109 --> 00:56:06,480
couldn't make it because of the time

1365
00:56:10,700 --> 00:56:09,119
change the time difference she couldn't

1366
00:56:13,430 --> 00:56:10,710
she couldn't attend this week but she

1367
00:56:14,690 --> 00:56:13,440
will also be back next week and so thank

1368
00:56:16,460 --> 00:56:14,700
you all for watching thank you for

1369
00:56:20,329 --> 00:56:16,470
commenting thank you for questioning and