1
00:01:41,190 --> 00:01:38,950
good evening welcome to the space

2
00:01:43,350 --> 00:01:41,200
telescope science institute in baltimore

3
00:01:45,830 --> 00:01:43,360
i'm don savage public affairs officer

4
00:01:47,350 --> 00:01:45,840
for nasa's office of space science this

5
00:01:48,870 --> 00:01:47,360
evening we're pleased to announce the

6
00:01:50,310 --> 00:01:48,880
start of a week-long campaign of

7
00:01:51,990 --> 00:01:50,320
observations

8
00:01:54,710 --> 00:01:52,000
of the impact of periodic comet

9
00:01:56,710 --> 00:01:54,720
shoemaker levy 9 with jupiter the impact

10
00:01:59,109 --> 00:01:56,720
of the first fragment occurred earlier

11
00:02:00,149 --> 00:01:59,119
this afternoon at about 3 54 and

12
00:02:01,990 --> 00:02:00,159
scientists around the world

13
00:02:04,230 --> 00:02:02,000

participating in the nasa national

14
00:02:06,550 --> 00:02:04,240
science foundation observing campaign as

15
00:02:08,389 --> 00:02:06,560
well as virtually every other telescope

16
00:02:10,469 --> 00:02:08,399
and observatory around the world have

17
00:02:12,070 --> 00:02:10,479
been watching

18
00:02:14,949 --> 00:02:12,080
that included of course the hubble space

19
00:02:16,869 --> 00:02:14,959
telescope which is where we are located

20
00:02:19,110 --> 00:02:16,879
here at the institute an image of the

21
00:02:20,869 --> 00:02:19,120
area of jupiter which the fragment hit

22
00:02:23,510 --> 00:02:20,879
will be ready by about 10 o'clock

23
00:02:25,510 --> 00:02:23,520
tonight and at that time dr heidi hamill

24
00:02:27,110 --> 00:02:25,520
will provide the image and we'll discuss

25
00:02:29,510 --> 00:02:27,120
what you can tell from the early

26
00:02:32,309 --> 00:02:29,520
analysis of the data

27
00:02:34,150 --> 00:02:32,319
now i'd like to introduce our panel the

28
00:02:36,550 --> 00:02:34,160
discoverers and of course the namesake

29
00:02:39,270 --> 00:02:36,560
of the comet from my left

30
00:02:41,509 --> 00:02:39,280
dr eugene shoemaker floral

31
00:02:43,509 --> 00:02:41,519
lowell observatory

32
00:02:46,150 --> 00:02:43,519
he's a research professor at north

33
00:02:48,470 --> 00:02:46,160
arizona university in flagstaff and

34
00:02:50,710 --> 00:02:48,480
scientist emeritus at the u.s geological

35
00:02:53,270 --> 00:02:50,720
survey

36
00:02:55,270 --> 00:02:53,280
to his left dr carolyn shoemaker his

37
00:02:57,509 --> 00:02:55,280
wife also a staff member of lowell

38
00:03:00,229 --> 00:02:57,519

observatory and research professor at

39
00:03:03,589 --> 00:03:00,239
north arizona university and a volunteer

40
00:03:05,910 --> 00:03:03,599
scientist at the u.s geological survey

41
00:03:08,309 --> 00:03:05,920
and on the far left david levy amateur

42
00:03:11,350 --> 00:03:08,319
astronomer and author and he's

43
00:03:14,309 --> 00:03:11,360
discovered 21 comets and and in 1984

44
00:03:16,070 --> 00:03:14,319
eight in his own backyard and 13 with

45
00:03:18,630 --> 00:03:16,080
working with gene and carolyn shoemaker

46
00:03:20,149 --> 00:03:18,640
and mount polymer

47
00:03:21,270 --> 00:03:20,159
dr shoemaker

48
00:03:22,949 --> 00:03:21,280
thanks don

49
00:03:25,030 --> 00:03:22,959
well it's a

50
00:03:26,710 --> 00:03:25,040
great great pleasure to be with you this

51
00:03:28,149 --> 00:03:26,720
evening

52
00:03:30,630 --> 00:03:28,159
we're here to

53
00:03:32,630 --> 00:03:30,640
start the reporting on like on a

54
00:03:36,229 --> 00:03:32,640
campaign that's been

55
00:03:37,830 --> 00:03:36,239
16 months in preparation

56
00:03:39,830 --> 00:03:37,840
since the discovery of the comet we were

57
00:03:42,789 --> 00:03:39,840
very fortunate to be able to discover

58
00:03:44,869 --> 00:03:42,799
this comet far enough ahead of time

59
00:03:47,110 --> 00:03:44,879
that astronomers around the world could

60
00:03:48,710 --> 00:03:47,120
actually plan carefully

61
00:03:51,670 --> 00:03:48,720
an observing campaign get their

62
00:03:53,830 --> 00:03:51,680
observing requests into observatories

63
00:03:55,750 --> 00:03:53,840

and of course a campaign

64
00:03:58,070 --> 00:03:55,760
has been carried out is being carried

65
00:04:01,030 --> 00:03:58,080
out with a hubble space telescope

66
00:04:02,789 --> 00:04:01,040
which is guided from here uh

67
00:04:04,470 --> 00:04:02,799
as the staff the planning is done from

68
00:04:06,309 --> 00:04:04,480
here

69
00:04:08,070 --> 00:04:06,319
and the hubble has been very important

70
00:04:10,470 --> 00:04:08,080
actually in obtaining some of our best

71
00:04:12,470 --> 00:04:10,480
images of the comet over the course of

72
00:04:14,630 --> 00:04:12,480
the past year actually starting july

73
00:04:16,870 --> 00:04:14,640
year ago and i think we're very lucky of

74
00:04:18,469 --> 00:04:16,880
course to have the new improved optics

75
00:04:21,030 --> 00:04:18,479
on hubble which are going to prove their

76
00:04:22,230 --> 00:04:21,040
worth tonight and through the rest of

77
00:04:24,790 --> 00:04:22,240
this week

78
00:04:26,310 --> 00:04:24,800
not only have been have observers been

79
00:04:28,950 --> 00:04:26,320
preparing

80
00:04:29,990 --> 00:04:28,960
but there have been several teams

81
00:04:32,310 --> 00:04:30,000
of

82
00:04:34,710 --> 00:04:32,320
theorists around the world mostly in the

83
00:04:37,350 --> 00:04:34,720
u.s who worked very hard to try to

84
00:04:39,830 --> 00:04:37,360
predict what the effects of the impacts

85
00:04:42,550 --> 00:04:39,840
of the comet fragments would be

86
00:04:45,110 --> 00:04:42,560
i and what i i want to show you very

87
00:04:47,510 --> 00:04:45,120
briefly is what i regard as the

88
00:04:49,350 --> 00:04:47,520

as the latest and best prediction

89
00:04:51,510 --> 00:04:49,360
for the eruptive plume that will be

90
00:04:53,270 --> 00:04:51,520
formed by an individual comet nucleus of

91
00:04:55,110 --> 00:04:53,280
a kilometer diameter

92
00:04:57,030 --> 00:04:55,120
plunging into the atmosphere of jupiter

93
00:04:59,270 --> 00:04:57,040
45 degrees

94
00:05:01,270 --> 00:04:59,280
the work i'm going to show you actually

95
00:05:03,830 --> 00:05:01,280
has just been completed it's a team

96
00:05:06,710 --> 00:05:03,840
effort primarily carried out by paul

97
00:05:08,550 --> 00:05:06,720
hashig that titan research corporation

98
00:05:12,390 --> 00:05:08,560
who's a close colleague of ours my

99
00:05:14,790 --> 00:05:12,400
colleague david levy david roddy

100
00:05:16,710 --> 00:05:14,800
i have two davids in my life

101
00:05:18,070 --> 00:05:16,720
david roddy was my first graduate

102
00:05:20,230 --> 00:05:18,080
student and as a colleague of mine at

103
00:05:21,990 --> 00:05:20,240
the usgs

104
00:05:23,749 --> 00:05:22,000
and andrew ingersoll who's a professor

105
00:05:26,629 --> 00:05:23,759
at caltech

106
00:05:28,310 --> 00:05:26,639
and i think that we we have probably the

107
00:05:30,390 --> 00:05:28,320
best simulation

108
00:05:31,430 --> 00:05:30,400
on the computer of a plume that will

109
00:05:33,749 --> 00:05:31,440
erupt

110
00:05:35,110 --> 00:05:33,759
from beneath the cloud tops if we can

111
00:05:36,390 --> 00:05:35,120
now roll

112
00:05:40,950 --> 00:05:36,400
the

113
00:05:41,990 --> 00:05:40,960

going to go this is one and a half

114
00:05:43,749 --> 00:05:42,000
minutes

115
00:05:46,390 --> 00:05:43,759
if we can keep rolling

116
00:05:48,870 --> 00:05:46,400
this is two minutes

117
00:05:49,990 --> 00:05:48,880
and and the plume is growing this is now

118
00:05:51,990 --> 00:05:50,000
three minutes

119
00:05:54,550 --> 00:05:52,000
it's rising to a total height of about

120
00:05:57,029 --> 00:05:54,560
700 kilometers this is at four minutes

121
00:05:58,230 --> 00:05:57,039
the color it's getting cold at the top

122
00:06:01,189 --> 00:05:58,240
oops

123
00:06:06,230 --> 00:06:02,150
all right

124
00:06:08,550 --> 00:06:06,240
let's continue with the next one i

125
00:06:10,150 --> 00:06:08,560
is that the last one

126
00:06:11,749 --> 00:06:10,160
we don't know where a live signal came

127
00:06:13,189 --> 00:06:11,759
in there

128
00:06:14,469 --> 00:06:13,199
all right i guess that's as far as he

129
00:06:15,670 --> 00:06:14,479
can take the

130
00:06:17,909 --> 00:06:15,680
there we go

131
00:06:19,909 --> 00:06:17,919
the plume gets very cold and then

132
00:06:22,390 --> 00:06:19,919
finally falls back down you may not be

133
00:06:24,870 --> 00:06:22,400
able to see the dimensions in that block

134
00:06:27,990 --> 00:06:24,880
diagram but the plume spreads out

135
00:06:30,070 --> 00:06:28,000
more than two thousand kilometers across

136
00:06:32,550 --> 00:06:30,080
and it rises to a height of nearly a

137
00:06:34,710 --> 00:06:32,560
thousand kilometers at its at its

138
00:06:37,990 --> 00:06:34,720

greatest extent it reaches that greatest

139
00:06:39,270 --> 00:06:38,000
height in about five minutes

140
00:06:42,390 --> 00:06:39,280
now

141
00:06:44,710 --> 00:06:42,400
having done those calculations

142
00:06:46,469 --> 00:06:44,720
it gives me great satisfaction to be

143
00:06:48,550 --> 00:06:46,479
able to tell you that

144
00:06:50,550 --> 00:06:48,560
there have been two reports received at

145
00:06:52,870 --> 00:06:50,560
the university of maryland

146
00:06:55,990 --> 00:06:52,880
uh one from an observing team in

147
00:06:58,790 --> 00:06:56,000
colorado in grenada in spain

148
00:07:00,230 --> 00:06:58,800
headed by tom herbst and six other

149
00:07:03,189 --> 00:07:00,240
astronomers

150
00:07:06,469 --> 00:07:03,199
observing with a 3.5 meter telescope and

151
00:07:08,629 --> 00:07:06,479
observing in the 2.3 micron band that's

152
00:07:10,710 --> 00:07:08,639
an absorption band of methane

153
00:07:13,029 --> 00:07:10,720
so that jupiter becomes very dark in

154
00:07:15,110 --> 00:07:13,039
that band that's the best band to

155
00:07:17,110 --> 00:07:15,120
observe at if you want to see something

156
00:07:18,230 --> 00:07:17,120
bright that's rising above the cloud

157
00:07:20,950 --> 00:07:18,240
tops

158
00:07:23,990 --> 00:07:20,960
and they did in fact detect the plume

159
00:07:26,309 --> 00:07:24,000
at 2 18 universal time

160
00:07:28,469 --> 00:07:26,319
which is 18 minutes essentially after

161
00:07:31,830 --> 00:07:28,479
the predicted time by paul chodos and

162
00:07:34,629 --> 00:07:31,840
don yeomans at jpl for the impact now

163
00:07:36,390 --> 00:07:34,639

remember it took about five minutes for

164
00:07:39,430 --> 00:07:36,400
the plume to reach

165
00:07:41,350 --> 00:07:39,440
its full height and at about that time

166
00:07:43,430 --> 00:07:41,360
the plume actually would be rotated

167
00:07:45,990 --> 00:07:43,440
fairly close to the limb

168
00:07:47,589 --> 00:07:46,000
so i expect that the prediction is ac

169
00:07:50,390 --> 00:07:47,599
the actual impact

170
00:07:52,870 --> 00:07:50,400
probably was about 13 minutes

171
00:07:54,629 --> 00:07:52,880
after the predicted impact but that's

172
00:07:56,469 --> 00:07:54,639
very good because the standard deviation

173
00:07:58,070 --> 00:07:56,479
prediction is eight minutes

174
00:07:59,670 --> 00:07:58,080
uh and so it's about one and a half

175
00:08:01,909 --> 00:07:59,680
standard deviations off the prediction

176
00:08:04,390 --> 00:08:01,919
that's a very good prediction uh from

177
00:08:06,550 --> 00:08:04,400
the astronomical observations

178
00:08:08,150 --> 00:08:06,560
uh so it looks as though it was seen on

179
00:08:10,629 --> 00:08:08,160
the limb of the planet

180
00:08:12,869 --> 00:08:10,639
uh and in fact it was reported the plume

181
00:08:16,710 --> 00:08:12,879
is reported to be brighter than the

182
00:08:17,670 --> 00:08:16,720
satellite eo in the 2.3 micron van

183
00:08:19,430 --> 00:08:17,680
now

184
00:08:21,029 --> 00:08:19,440
we should all take these reports very

185
00:08:23,029 --> 00:08:21,039
carefully and cautiously at this time

186
00:08:25,029 --> 00:08:23,039
they need to be confirmed

187
00:08:27,430 --> 00:08:25,039
by other observers

188
00:08:29,990 --> 00:08:27,440

but i'm very happy to tell you the plume

189
00:08:32,949 --> 00:08:30,000
is also reported to be observed in the

190
00:08:34,230 --> 00:08:32,959
10 micron van by observers again with a

191
00:08:36,870 --> 00:08:34,240
3.6

192
00:08:38,149 --> 00:08:36,880
meter mic telescope at this

193
00:08:40,870 --> 00:08:38,159
site

194
00:08:43,190 --> 00:08:40,880
and and this is uh this is a 10 micron

195
00:08:45,350 --> 00:08:43,200
observation which is also this deep in

196
00:08:47,590 --> 00:08:45,360
the infrared and also

197
00:08:49,030 --> 00:08:47,600
a spectral region in which jupiter is

198
00:08:50,949 --> 00:08:49,040
not too bright to begin with so it's

199
00:08:53,509 --> 00:08:50,959
easier to see the plume there so the

200
00:08:56,870 --> 00:08:53,519
plume independently has been seen

201
00:08:59,269 --> 00:08:56,880
in chile as well as in spain

202
00:09:01,190 --> 00:08:59,279
so this is the moment of truth

203
00:09:03,030 --> 00:09:01,200
we have we have all

204
00:09:05,750 --> 00:09:03,040
speculated and tried to estimate the

205
00:09:07,509 --> 00:09:05,760
sizes of the nuclei

206
00:09:09,829 --> 00:09:07,519
and we've worried if the nuclei were at

207
00:09:11,750 --> 00:09:09,839
the smaller limit which is set actually

208
00:09:13,110 --> 00:09:11,760
by the dynamics the parent body could

209
00:09:15,430 --> 00:09:13,120
not have been much smaller than about

210
00:09:17,430 --> 00:09:15,440
two kilometers so the biggest fragments

211
00:09:19,190 --> 00:09:17,440
if there are single fragments would

212
00:09:20,230 --> 00:09:19,200
likely been only a few hundred meters

213
00:09:22,150 --> 00:09:20,240

across

214
00:09:24,550 --> 00:09:22,160
versus the other possibility the upper

215
00:09:27,350 --> 00:09:24,560
limit was set by observations with the

216
00:09:28,470 --> 00:09:27,360
space telescope last july and then later

217
00:09:30,550 --> 00:09:28,480
this year

218
00:09:32,470 --> 00:09:30,560
allowing uh the individual elijah's

219
00:09:34,550 --> 00:09:32,480
fragments being about three or maybe the

220
00:09:36,150 --> 00:09:34,560
largest four kilometers across

221
00:09:38,470 --> 00:09:36,160
we've assumed maybe the best bet

222
00:09:39,990 --> 00:09:38,480
somewhere in the middle at one kilometer

223
00:09:41,269 --> 00:09:40,000
but now remember we're observing

224
00:09:43,670 --> 00:09:41,279
fragment a

225
00:09:45,030 --> 00:09:43,680
which is one of the small fragments

226
00:09:47,829 --> 00:09:45,040
so i think there's very good news

227
00:09:50,230 --> 00:09:47,839
tonight if these reports are correct

228
00:09:53,030 --> 00:09:50,240
then you can expect a good show for

229
00:09:55,269 --> 00:09:53,040
every telescopic telescopically observed

230
00:09:57,030 --> 00:09:55,279
nucleus we're going to see things and

231
00:09:59,190 --> 00:09:57,040
we're going to learn a lot that's the

232
00:10:01,910 --> 00:09:59,200
good news tonight

233
00:10:03,990 --> 00:10:01,920
let me now turn the podium over to my

234
00:10:06,630 --> 00:10:04,000
wife carolyn we'll talk a little bit

235
00:10:10,870 --> 00:10:06,640
about the discovery

236
00:10:14,310 --> 00:10:10,880
the discovery of comet shoemaker levy 9

237
00:10:17,430 --> 00:10:14,320
was terrifically exciting in march of

238
00:10:22,870 --> 00:10:19,829

at that time to discover something like

239
00:10:24,230 --> 00:10:22,880
this was completely unbelievable to any

240
00:10:27,590 --> 00:10:24,240
of us

241
00:10:29,990 --> 00:10:27,600
it was a dark and stormy night

242
00:10:32,710 --> 00:10:30,000
to quote a famous phrase but it was a

243
00:10:35,750 --> 00:10:32,720
dark and stormy night on which

244
00:10:38,389 --> 00:10:35,760
this comet was discovered by us and by a

245
00:10:41,829 --> 00:10:38,399
young frenchman philippe benjoya from

246
00:10:45,350 --> 00:10:43,990
this was discovered in the course of our

247
00:10:48,310 --> 00:10:45,360
normal work

248
00:10:50,550 --> 00:10:48,320
as part of our routine survey

249
00:10:51,910 --> 00:10:50,560
happily it was a field that we were able

250
00:10:54,230 --> 00:10:51,920
to take

251
00:10:55,910 --> 00:10:54,240
in spite of the fact that a storm was

252
00:10:58,150 --> 00:10:55,920
moving in

253
00:11:00,790 --> 00:10:58,160
we took the films for this two nights

254
00:11:03,190 --> 00:11:00,800
before discovery

255
00:11:05,670 --> 00:11:03,200
and at that time we were very grateful

256
00:11:08,710 --> 00:11:05,680
that we were able to take anything we

257
00:11:11,750 --> 00:11:08,720
had had a bad two months of winter

258
00:11:15,509 --> 00:11:11,760
during which we took very few films

259
00:11:17,829 --> 00:11:15,519
so when we were had the chance to take

260
00:11:23,030 --> 00:11:17,839
any films that night and took this

261
00:11:28,389 --> 00:11:26,069
i searched these films two days later

262
00:11:30,310 --> 00:11:28,399
in the my usual way

263
00:11:33,829 --> 00:11:30,320

but maybe i should back up a little and

264
00:11:35,750 --> 00:11:33,839
tell you how does this team work

265
00:11:39,269 --> 00:11:35,760
first of all there's the telescope in

266
00:11:41,990 --> 00:11:39,279
the 18-inch dome which is the oldest

267
00:11:46,310 --> 00:11:42,000
telescope on palomar mountain it is

268
00:11:49,670 --> 00:11:46,320
palomar mountain not mount palomar

269
00:11:50,870 --> 00:11:49,680
this is a an 18-inch schmidt it's a

270
00:11:53,509 --> 00:11:50,880
camera

271
00:11:54,829 --> 00:11:53,519
and we take pairs of films

272
00:11:59,670 --> 00:11:54,839
of one

273
00:12:02,230 --> 00:11:59,680
field by taking pairs of films

274
00:12:04,470 --> 00:12:02,240
of one field i can look at them under a

275
00:12:05,509 --> 00:12:04,480
stereo microscope

276
00:12:08,470 --> 00:12:05,519
and

277
00:12:10,710 --> 00:12:08,480
detect images that appear to float in

278
00:12:13,190 --> 00:12:10,720
three in a 3d effect

279
00:12:14,550 --> 00:12:13,200
the stars lie down nice and flat the

280
00:12:16,389 --> 00:12:14,560
galaxies

281
00:12:19,590 --> 00:12:16,399
lie down nice and flat

282
00:12:22,470 --> 00:12:19,600
asteroids and comets appear to float

283
00:12:24,710 --> 00:12:22,480
it's a wonderful technique

284
00:12:25,829 --> 00:12:24,720
during our night of observing

285
00:12:27,030 --> 00:12:25,839
david

286
00:12:29,430 --> 00:12:27,040
and gene

287
00:12:31,750 --> 00:12:29,440
are usually up on the observing floor

288
00:12:34,150 --> 00:12:31,760

one of them is guiding this telescope

289
00:12:36,150 --> 00:12:34,160
which is open to the sky it's a very

290
00:12:37,990 --> 00:12:36,160
old-fashioned technique that isn't used

291
00:12:41,590 --> 00:12:38,000
much anymore

292
00:12:43,910 --> 00:12:41,600
we actually do see the sky as we observe

293
00:12:46,629 --> 00:12:43,920
one of them is on the telescope

294
00:12:48,949 --> 00:12:46,639
guiding the other one is busy putting

295
00:12:50,069 --> 00:12:48,959
the person on the telescope on the right

296
00:12:52,389 --> 00:12:50,079
field

297
00:12:55,430 --> 00:12:52,399
changing the film going up and down

298
00:12:57,590 --> 00:12:55,440
stairs and then setting up

299
00:13:01,350 --> 00:12:57,600
helping set up the telescope for the

300
00:13:04,710 --> 00:13:03,990
every four fields they

301
00:13:06,790 --> 00:13:04,720
take

302
00:13:09,509 --> 00:13:06,800
their own turn in

303
00:13:10,870 --> 00:13:09,519
one changes and gets on the telescope

304
00:13:14,150 --> 00:13:10,880
and the other one

305
00:13:16,389 --> 00:13:14,160
does the running up and down the stairs

306
00:13:19,190 --> 00:13:16,399
after about eight fields

307
00:13:22,230 --> 00:13:19,200
i usually develop the films

308
00:13:23,430 --> 00:13:22,240
and after i finish developing the films

309
00:13:26,230 --> 00:13:23,440
i scan

310
00:13:28,150 --> 00:13:26,240
any of those that are dry so that's our

311
00:13:31,350 --> 00:13:28,160
general procedure

312
00:13:33,190 --> 00:13:31,360
but on that dark and stormy night

313
00:13:35,750 --> 00:13:33,200

we were not able to do that sort of

314
00:13:37,269 --> 00:13:35,760
thing we were i was scanning fields

315
00:13:39,430 --> 00:13:37,279
trying to catch up

316
00:13:41,269 --> 00:13:39,440
with what we had already taken and the

317
00:13:43,110 --> 00:13:41,279
others were doing their usual thing

318
00:13:45,269 --> 00:13:43,120
david writes books

319
00:13:48,870 --> 00:13:45,279
gene was busy with office work of some

320
00:13:51,509 --> 00:13:48,880
sort and philippe was also there and

321
00:13:53,509 --> 00:13:51,519
i was trying to be careful if i clear my

322
00:13:56,949 --> 00:13:53,519
throat or cough a little they all snap

323
00:13:58,150 --> 00:13:56,959
to attention and say what have you found

324
00:14:00,150 --> 00:13:58,160
well

325
00:14:02,470 --> 00:14:00,160
that that night i

326
00:14:04,790 --> 00:14:02,480
had just finished my usual litany when

327
00:14:06,870 --> 00:14:04,800
i'm beginning to feel desperate i was at

328
00:14:09,350 --> 00:14:06,880
the at the end of the

329
00:14:10,710 --> 00:14:09,360
coming close to the end of the films

330
00:14:12,870 --> 00:14:10,720
that we had taken

331
00:14:16,389 --> 00:14:12,880
and i turned to david and said

332
00:14:17,350 --> 00:14:16,399
i used to be a person who found comets

333
00:14:19,509 --> 00:14:17,360
and then

334
00:14:21,910 --> 00:14:19,519
that usually helps a little bit and i

335
00:14:23,590 --> 00:14:21,920
started to scan the field that had

336
00:14:26,629 --> 00:14:23,600
jupiter on it

337
00:14:29,269 --> 00:14:26,639
for me that's been a lucky field

338
00:14:31,910 --> 00:14:29,279

i found another comet on a jupiter field

339
00:14:34,629 --> 00:14:31,920
once when i was busy confirming a comet

340
00:14:37,350 --> 00:14:34,639
for another observer on that same field

341
00:14:39,430 --> 00:14:37,360
so i was hopeful that maybe just maybe

342
00:14:42,150 --> 00:14:39,440
something would turn up

343
00:14:44,550 --> 00:14:42,160
and sure enough halfway down after i'd

344
00:14:47,590 --> 00:14:44,560
come across jupiter and after i had seen

345
00:14:50,389 --> 00:14:47,600
jupiter's ghost image on the film

346
00:14:52,710 --> 00:14:50,399
there was a strange looking object

347
00:14:54,389 --> 00:14:52,720
i almost went past and then i said

348
00:14:57,269 --> 00:14:54,399
whoops

349
00:14:58,790 --> 00:14:57,279
i should go back to that and i i moved

350
00:15:01,350 --> 00:14:58,800
the film back

351
00:15:03,829 --> 00:15:01,360
and looked harder and decided that's not

352
00:15:05,670 --> 00:15:03,839
an edge on galaxy because we see

353
00:15:07,590 --> 00:15:05,680
galaxy's face on

354
00:15:08,949 --> 00:15:07,600
turned a little cockeyed

355
00:15:14,870 --> 00:15:08,959
edge on

356
00:15:16,949 --> 00:15:14,880
had coma and tail and most importantly

357
00:15:19,269 --> 00:15:16,959
to me it floated

358
00:15:21,750 --> 00:15:19,279
it had to float or i wouldn't have seen

359
00:15:25,110 --> 00:15:21,760
it in my in three dimensions

360
00:15:27,430 --> 00:15:25,120
and so i knew that was a comet i always

361
00:15:31,030 --> 00:15:27,440
have this deep inner feeling when i find

362
00:15:33,590 --> 00:15:31,040
a comet if i have to wonder it isn't

363
00:15:35,430 --> 00:15:33,600

in this case i knew i had a comet but it

364
00:15:38,069 --> 00:15:35,440
was strange looking

365
00:15:41,670 --> 00:15:38,079
it looked like a bar instead of the

366
00:15:42,870 --> 00:15:41,680
usual round halo with an atmosphere or

367
00:15:44,389 --> 00:15:42,880
coma

368
00:15:46,949 --> 00:15:44,399
and a tail

369
00:15:48,629 --> 00:15:46,959
it was a bar with coma

370
00:15:51,590 --> 00:15:48,639
and tail

371
00:15:53,910 --> 00:15:51,600
and i thought that that's not natural

372
00:15:55,189 --> 00:15:53,920
i turned to the others because i always

373
00:15:58,470 --> 00:15:55,199
bring them in

374
00:16:01,509 --> 00:15:58,480
on any discovery as soon as i can

375
00:16:03,030 --> 00:16:01,519
it takes all of us working very hard all

376
00:16:05,670 --> 00:16:03,040
of the time

377
00:16:08,150 --> 00:16:05,680
to make these discoveries and it's their

378
00:16:10,310 --> 00:16:08,160
discovery as much as mine i'm just lucky

379
00:16:12,710 --> 00:16:10,320
enough to have seen it first

380
00:16:14,629 --> 00:16:12,720
but i wanted them to see it right away

381
00:16:18,150 --> 00:16:14,639
and furthermore i wanted them to tell me

382
00:16:21,590 --> 00:16:19,749
i turned and said

383
00:16:24,150 --> 00:16:21,600
i don't know what i've got but it looks

384
00:16:26,069 --> 00:16:24,160
like a squashed comet and they really

385
00:16:28,710 --> 00:16:26,079
snapped too that time

386
00:16:31,110 --> 00:16:28,720
and gene rushed over and looked at it

387
00:16:33,990 --> 00:16:31,120
and looked very puzzled and then david

388
00:16:36,550 --> 00:16:34,000

took his turn and was equally confused

389
00:16:38,550 --> 00:16:36,560
and philippe took his turn he was

390
00:16:41,990 --> 00:16:38,560
interested in part because he had been

391
00:16:45,030 --> 00:16:42,000
studying for his phd in france the break

392
00:16:47,189 --> 00:16:45,040
the not so much the breakup but families

393
00:16:48,870 --> 00:16:47,199
of asteroids which would be caused by

394
00:16:52,230 --> 00:16:48,880
breka

395
00:16:54,710 --> 00:16:52,240
and we were very very

396
00:16:56,150 --> 00:16:54,720
bemused by all this we couldn't imagine

397
00:16:59,189 --> 00:16:56,160
what it was

398
00:17:01,350 --> 00:16:59,199
as as david often says our brains sort

399
00:17:04,470 --> 00:17:01,360
of turn off for a minute we get a rush

400
00:17:06,150 --> 00:17:04,480
of adrenaline and and we were excited

401
00:17:07,990 --> 00:17:06,160
and we thought we found something

402
00:17:09,990 --> 00:17:08,000
unusual

403
00:17:12,150 --> 00:17:10,000
so that was the beginning of this

404
00:17:15,510 --> 00:17:12,160
wonderful event that has led to a

405
00:17:16,630 --> 00:17:15,520
culmination tonight

406
00:17:18,390 --> 00:17:16,640
during this

407
00:17:19,590 --> 00:17:18,400
time that has ensued

408
00:17:22,390 --> 00:17:19,600
we had

409
00:17:24,309 --> 00:17:22,400
a vast amount of surprise and excitement

410
00:17:25,270 --> 00:17:24,319
when we first of all discovered that the

411
00:17:27,829 --> 00:17:25,280
comet

412
00:17:29,830 --> 00:17:27,839
was in orbit about jupiter that was the

413
00:17:31,750 --> 00:17:29,840

first ever

414
00:17:33,990 --> 00:17:31,760
and then a couple of months later when

415
00:17:37,110 --> 00:17:34,000
we discovered that this was a comet that

416
00:17:39,830 --> 00:17:37,120
was going to actually impact jupiter

417
00:17:43,750 --> 00:17:39,840
a first ever a comet scene impacting a

418
00:17:45,590 --> 00:17:43,760
planet that was really exciting

419
00:17:47,029 --> 00:17:45,600
i was a little dismayed i'll have to

420
00:17:48,230 --> 00:17:47,039
admit

421
00:17:50,470 --> 00:17:48,240
i thought

422
00:17:51,990 --> 00:17:50,480
i would never lose a comet in such a

423
00:17:54,390 --> 00:17:52,000
fashion

424
00:17:55,750 --> 00:17:54,400
i was actually going to lose one of my

425
00:17:57,430 --> 00:17:55,760
problems

426
00:18:00,630 --> 00:17:57,440
and that that was

427
00:18:03,029 --> 00:18:00,640
a momentary bit of sadness and then i

428
00:18:04,870 --> 00:18:03,039
thought oh but how exciting

429
00:18:05,990 --> 00:18:04,880
everyone will get to see a comet hit

430
00:18:09,110 --> 00:18:06,000
jupiter

431
00:18:12,070 --> 00:18:09,120
but at that time i had no conception

432
00:18:15,190 --> 00:18:12,080
of all that was going to ensue i had no

433
00:18:17,270 --> 00:18:15,200
conception of how much

434
00:18:20,950 --> 00:18:17,280
all of us stood to learn

435
00:18:22,070 --> 00:18:20,960
about comets about a planet in our solar

436
00:18:24,230 --> 00:18:22,080
system

437
00:18:26,549 --> 00:18:24,240
just from the discovery of this

438
00:18:28,470 --> 00:18:26,559

particular comet

439
00:18:31,510 --> 00:18:28,480
and that to me has been one of the more

440
00:18:33,990 --> 00:18:31,520
exciting things to see people from many

441
00:18:36,789 --> 00:18:34,000
different areas and disciplines of

442
00:18:39,110 --> 00:18:36,799
planetary science and astronomy

443
00:18:41,830 --> 00:18:39,120
bring together come together with their

444
00:18:43,190 --> 00:18:41,840
knowledge work together to get the most

445
00:18:46,390 --> 00:18:43,200
out of this

446
00:18:49,190 --> 00:18:46,400
so that that has been a wonderful thing

447
00:18:52,150 --> 00:18:49,200
and then this afternoon about the time

448
00:18:53,830 --> 00:18:52,160
that i knew that comet was going to

449
00:18:56,310 --> 00:18:53,840
hit jupiter

450
00:18:59,830 --> 00:18:56,320
fragment a i suddenly discovered i had a

451
00:19:02,310 --> 00:18:59,840
real emotional attachment to this comet

452
00:19:05,350 --> 00:19:02,320
during all this time it's been a thing

453
00:19:09,350 --> 00:19:05,360
of great beauty to me out there

454
00:19:11,909 --> 00:19:09,360
the first images i saw after jim scotty

455
00:19:14,150 --> 00:19:11,919
showed us his and after i saw

456
00:19:15,830 --> 00:19:14,160
dave jewett and jane lose images from

457
00:19:17,590 --> 00:19:15,840
hawaii

458
00:19:20,470 --> 00:19:17,600
just

459
00:19:23,270 --> 00:19:20,480
captured my imagination and and that

460
00:19:25,510 --> 00:19:23,280
image has been there ever since and yet

461
00:19:27,029 --> 00:19:25,520
here it was fragment a was going to hit

462
00:19:29,510 --> 00:19:27,039
jupiter

463
00:19:31,990 --> 00:19:29,520

and i'll have to admit i i had a

464
00:19:34,150 --> 00:19:32,000
momentary tear at the

465
00:19:37,590 --> 00:19:34,160
very prospect when i knew that moment

466
00:19:38,630 --> 00:19:37,600
had happened well that's gone

467
00:19:41,110 --> 00:19:38,640
but

468
00:19:44,950 --> 00:19:41,120
just a few hours later than the sudden

469
00:19:47,270 --> 00:19:44,960
news of actually seeing something from

470
00:19:49,669 --> 00:19:47,280
spain and from chile

471
00:19:52,470 --> 00:19:49,679
that's that's terrifically exciting all

472
00:19:54,070 --> 00:19:52,480
i could say was right and

473
00:19:55,590 --> 00:19:54,080
and so

474
00:19:57,029 --> 00:19:55,600
that is one of the

475
00:19:59,430 --> 00:19:57,039
phases

476
00:20:01,590 --> 00:19:59,440
of this whole commentary experience i

477
00:20:02,870 --> 00:20:01,600
think that has been wonderful for all of

478
00:20:05,669 --> 00:20:02,880
us

479
00:20:08,150 --> 00:20:05,679
now i'd like to turn the making over

480
00:20:10,230 --> 00:20:08,160
to david levy who is a

481
00:20:13,350 --> 00:20:10,240
well-known writer

482
00:20:14,470 --> 00:20:13,360
particularly about astronomical things a

483
00:20:16,630 --> 00:20:14,480
lecture

484
00:20:19,110 --> 00:20:16,640
and a very close colleague

485
00:20:24,150 --> 00:20:19,120
thanks carolyn that is a tough act to

486
00:20:29,350 --> 00:20:27,830
i think the exciting thing about tonight

487
00:20:31,430 --> 00:20:29,360
is that

488
00:20:33,830 --> 00:20:31,440

once in a generation

489
00:20:35,830 --> 00:20:33,840
we get one of those if we're lucky if

490
00:20:37,110 --> 00:20:35,840
we're lucky we get one of those rare

491
00:20:39,590 --> 00:20:37,120
moments

492
00:20:41,430 --> 00:20:39,600
when science

493
00:20:43,590 --> 00:20:41,440
stops for a moment

494
00:20:45,990 --> 00:20:43,600
turns on its ear and gives us something

495
00:20:49,750 --> 00:20:46,000
really really special

496
00:20:52,310 --> 00:20:49,760
in the early 1950s the discovery of dna

497
00:20:53,990 --> 00:20:52,320
did so much to

498
00:20:56,470 --> 00:20:54,000
it was a discovery

499
00:20:58,950 --> 00:20:56,480
and we learned an awful lot but the real

500
00:21:02,310 --> 00:20:58,960
thing that that discovery did was that

501
00:21:03,750 --> 00:21:02,320
everyone who was young at that time

502
00:21:05,350 --> 00:21:03,760
looked at all the news about the

503
00:21:07,909 --> 00:21:05,360
discovery

504
00:21:10,390 --> 00:21:07,919
studied it and they said science is

505
00:21:12,070 --> 00:21:10,400
fabulous you can you can uncover the

506
00:21:14,230 --> 00:21:12,080
mysteries of life

507
00:21:17,190 --> 00:21:14,240
when you get discoveries like this

508
00:21:20,070 --> 00:21:17,200
in 1969 there was the apollo 11 moon

509
00:21:22,710 --> 00:21:20,080
landing almost exactly 25 years ago

510
00:21:25,909 --> 00:21:22,720
that another generation paused for a

511
00:21:28,789 --> 00:21:25,919
moment i remember at a summer camp in

512
00:21:32,630 --> 00:21:28,799
lake placid we had about 160 people

513
00:21:34,149 --> 00:21:32,640

watching a television set about this big

514
00:21:36,789 --> 00:21:34,159
watching the

515
00:21:37,590 --> 00:21:36,799
watching that first small step take

516
00:21:39,350 --> 00:21:37,600
place

517
00:21:40,390 --> 00:21:39,360
and the youngest people in that audience

518
00:21:41,510 --> 00:21:40,400
were

519
00:21:43,190 --> 00:21:41,520
couldn't have been

520
00:21:45,350 --> 00:21:43,200
seven years old

521
00:21:46,149 --> 00:21:45,360
and the entire camp was there

522
00:21:49,669 --> 00:21:46,159
for

523
00:21:51,510 --> 00:21:49,679
four hours and nobody said anything

524
00:21:53,669 --> 00:21:51,520
everybody was

525
00:21:55,669 --> 00:21:53,679
absolutely quiet because

526
00:21:57,510 --> 00:21:55,679
this was we knew that this this was one

527
00:21:59,669 --> 00:21:57,520
of those moments

528
00:22:01,750 --> 00:21:59,679
there have been other moments as well

529
00:22:05,350 --> 00:22:01,760
but i'm really beginning to think that

530
00:22:07,990 --> 00:22:05,360
the impact of a comet on jupiter

531
00:22:09,190 --> 00:22:08,000
can be one such moment a moment with the

532
00:22:10,549 --> 00:22:09,200
power

533
00:22:14,870 --> 00:22:10,559
to

534
00:22:17,190 --> 00:22:14,880
fun

535
00:22:19,750 --> 00:22:17,200
to study science

536
00:22:20,630 --> 00:22:19,760
nature every now and then throws us a

537
00:22:23,430 --> 00:22:20,640
real

538
00:22:25,270 --> 00:22:23,440

ball that we can shoot out of the park

539
00:22:29,029 --> 00:22:25,280
and i think this is what's happening

540
00:22:32,230 --> 00:22:29,039
here cometary impacts have had enormous

541
00:22:35,430 --> 00:22:32,240
influence on our past

542
00:22:37,669 --> 00:22:35,440
uh it is very likely that they provided

543
00:22:40,310 --> 00:22:37,679
commentary impacts provided the water

544
00:22:42,310 --> 00:22:40,320
that is on the earth right now it is

545
00:22:44,549 --> 00:22:42,320
likely that they provided the building

546
00:22:47,990 --> 00:22:44,559
blocks of life the simple alphabet of

547
00:22:49,669 --> 00:22:48,000
life c-h-o-n carbon hydrogen oxygen and

548
00:22:51,430 --> 00:22:49,679
nitrogen

549
00:22:54,310 --> 00:22:51,440
a comet hitting the earth may be an

550
00:22:55,590 --> 00:22:54,320
asteroid hitting the earth 65 million

551
00:22:57,669 --> 00:22:55,600
years ago

552
00:22:59,750 --> 00:22:57,679
probably led to the demise of more than

553
00:23:03,669 --> 00:22:59,760
70 percent of the species of life on

554
00:23:05,990 --> 00:23:03,679
earth including the dinosaurs

555
00:23:07,430 --> 00:23:06,000
we have seen the results of comet

556
00:23:09,750 --> 00:23:07,440
impacts

557
00:23:11,270 --> 00:23:09,760
i think we being here is one of those

558
00:23:13,029 --> 00:23:11,280
results

559
00:23:15,350 --> 00:23:13,039
we have seen if you go outside and look

560
00:23:16,950 --> 00:23:15,360
at the moon on any clear night with a

561
00:23:19,830 --> 00:23:16,960
pair of binoculars you'll see enough

562
00:23:21,510 --> 00:23:19,840
craters impact craters that gene has

563
00:23:23,510 --> 00:23:21,520

studied in his life

564
00:23:25,510 --> 00:23:23,520
that you will

565
00:23:27,350 --> 00:23:25,520
be able to see that the earth and the

566
00:23:28,789 --> 00:23:27,360
moon have been hit by craters throughout

567
00:23:30,950 --> 00:23:28,799
their history

568
00:23:33,270 --> 00:23:30,960
we've seen all this we understand a

569
00:23:35,350 --> 00:23:33,280
little bit about it what we haven't seen

570
00:23:36,470 --> 00:23:35,360
is an actual impact take place i'll

571
00:23:39,110 --> 00:23:36,480
never forget

572
00:23:40,789 --> 00:23:39,120
may 22nd it was my birthday we were all

573
00:23:42,149 --> 00:23:40,799
at palomar mountain

574
00:23:43,029 --> 00:23:42,159
carolyn is

575
00:23:46,789 --> 00:23:43,039
is

576
00:23:49,029 --> 00:23:46,799
scam that would have proved successful

577
00:23:50,390 --> 00:23:49,039
in the next few hours when she found our

578
00:23:52,549 --> 00:23:50,400
next comment

579
00:23:54,789 --> 00:23:52,559
jean was in the dark room getting ready

580
00:23:56,230 --> 00:23:54,799
for our observing that night and i was

581
00:23:58,230 --> 00:23:56,240
checking the mail to see if there were

582
00:24:00,950 --> 00:23:58,240
any interesting objects that we would

583
00:24:03,669 --> 00:24:00,960
have to observe that night to follow up

584
00:24:06,230 --> 00:24:03,679
new discoveries some things like that

585
00:24:08,070 --> 00:24:06,240
and i logged into the email there were

586
00:24:10,390 --> 00:24:08,080
two circulars from the central bureau

587
00:24:11,269 --> 00:24:10,400
for astronomical telegrams

588
00:24:15,990 --> 00:24:11,279

and

589
00:24:17,190 --> 00:24:16,000
the floor

590
00:24:19,909 --> 00:24:17,200
it announced that there was a good

591
00:24:21,909 --> 00:24:19,919
possibility that comet shoemaker levy 9

592
00:24:23,909 --> 00:24:21,919
would be hitting jupiter in july of

593
00:24:24,870 --> 00:24:23,919
1994.

594
00:24:27,350 --> 00:24:24,880
and

595
00:24:29,510 --> 00:24:27,360
i said that i i said

596
00:24:32,390 --> 00:24:29,520
our comet's going to hit jupiter

597
00:24:35,029 --> 00:24:32,400
jean has spent his entire life studying

598
00:24:37,430 --> 00:24:35,039
impacts from his phd thesis to prove

599
00:24:38,390 --> 00:24:37,440
that media crater was the result of an

600
00:24:40,070 --> 00:24:38,400
impact

601
00:24:42,070 --> 00:24:40,080
from the work he did on the apollo

602
00:24:45,350 --> 00:24:42,080
program from the work he's done for the

603
00:24:48,390 --> 00:24:45,360
last 25 the last 15 years

604
00:24:50,310 --> 00:24:48,400
studying not the craters so much as the

605
00:24:52,230 --> 00:24:50,320
objects that sometimes make the craters

606
00:24:53,990 --> 00:24:52,240
the comets and the asteroids

607
00:24:55,269 --> 00:24:54,000
and here he is in the dark room and i

608
00:24:58,070 --> 00:24:55,279
just told him that we're going to see an

609
00:25:01,269 --> 00:24:58,080
impact on jupiter and i heard this

610
00:25:03,750 --> 00:25:01,279
slamming of doors and closing of lids as

611
00:25:05,909 --> 00:25:03,760
he's trying to save the film before he

612
00:25:07,750 --> 00:25:05,919
throws the dark room door open pushes me

613
00:25:09,909 --> 00:25:07,760

out of my computer chair and sits down

614
00:25:12,149 --> 00:25:09,919
looks at my screen and says

615
00:25:12,830 --> 00:25:12,159
i don't believe it we are going to see

616
00:25:18,149 --> 00:25:12,840
an

617
00:25:20,870 --> 00:25:18,159
since may 22nd of last year it has been

618
00:25:23,350 --> 00:25:20,880
just one excitement after another

619
00:25:25,110 --> 00:25:23,360
this is not a comet just for the

620
00:25:28,070 --> 00:25:25,120
professional scientists this is

621
00:25:30,149 --> 00:25:28,080
everybody's comment

622
00:25:32,230 --> 00:25:30,159
we've heard a lot that you're not going

623
00:25:33,990 --> 00:25:32,240
to see anything with the small telescope

624
00:25:35,830 --> 00:25:34,000
that you buy at a store or that you

625
00:25:37,190 --> 00:25:35,840
build yourself

626
00:25:39,190 --> 00:25:37,200
that's true

627
00:25:41,269 --> 00:25:39,200
you're not going to see jupiter

628
00:25:42,710 --> 00:25:41,279
show major changes from this impact but

629
00:25:44,549 --> 00:25:42,720
you don't have to

630
00:25:47,029 --> 00:25:44,559
that's why we have a fabulous hubble

631
00:25:48,950 --> 00:25:47,039
space telescope that's why we have the

632
00:25:50,390 --> 00:25:48,960
large telescopes on the ground and

633
00:25:52,870 --> 00:25:50,400
that's why we have television to

634
00:25:54,549 --> 00:25:52,880
transmit those pictures to everybody

635
00:25:56,789 --> 00:25:54,559
what we do have to do

636
00:25:59,830 --> 00:25:56,799
is to go outside with small telescopes

637
00:26:01,990 --> 00:25:59,840
binoculars and just look up at jupiter

638
00:26:03,750 --> 00:26:02,000

with a pair of binoculars you can mount

639
00:26:06,070 --> 00:26:03,760
it well against the wall of a building

640
00:26:08,230 --> 00:26:06,080
you're going to see the moons of jupiter

641
00:26:10,630 --> 00:26:08,240
revolve around that planet

642
00:26:12,149 --> 00:26:10,640
not in one night but if you look every

643
00:26:15,909 --> 00:26:12,159
night you'll see them in different

644
00:26:17,510 --> 00:26:15,919
positions just like galileo did in 1610.

645
00:26:21,029 --> 00:26:17,520
with a small telescope you're going to

646
00:26:22,630 --> 00:26:21,039
see the bands of cloud around jupiter

647
00:26:24,950 --> 00:26:22,640
that that are part of jupiter's

648
00:26:27,110 --> 00:26:24,960
atmosphere the bigger the telescope is

649
00:26:29,190 --> 00:26:27,120
the more of those details you'll get

650
00:26:31,350 --> 00:26:29,200
the important thing is if you make those

651
00:26:33,990 --> 00:26:31,360
simple observations

652
00:26:35,990 --> 00:26:34,000
even if you have no pair of binoculars

653
00:26:38,310 --> 00:26:36,000
just go out and look at jupiter each

654
00:26:40,070 --> 00:26:38,320
night you'll see it move slightly

655
00:26:42,310 --> 00:26:40,080
relative to the stars

656
00:26:44,710 --> 00:26:42,320
these are observations anybody can make

657
00:26:46,710 --> 00:26:44,720
without any telescope anything

658
00:26:49,350 --> 00:26:46,720
to just look at jupiter it's high in the

659
00:26:51,110 --> 00:26:49,360
southwestern sky these evenings

660
00:26:53,750 --> 00:26:51,120
very bright the brightest star in that

661
00:26:55,510 --> 00:26:53,760
area star the brightest planet

662
00:26:58,470 --> 00:26:55,520
in that area the brightest object in the

663
00:26:59,350 --> 00:26:58,480

sky in that part of the sky

664
00:27:01,990 --> 00:26:59,360
and

665
00:27:03,430 --> 00:27:02,000
this way everybody can be a part of this

666
00:27:06,230 --> 00:27:03,440
event you'll be able to look up a

667
00:27:09,350 --> 00:27:06,240
jupiter and say i saw jupiter the week

668
00:27:10,950 --> 00:27:09,360
the comet hit and then you come inside

669
00:27:13,190 --> 00:27:10,960
see the results on hubble space

670
00:27:15,269 --> 00:27:13,200
telescope later on

671
00:27:18,230 --> 00:27:15,279
the galileo spacecraft

672
00:27:21,110 --> 00:27:18,240
we are so extremely lucky

673
00:27:23,430 --> 00:27:21,120
that the impact which might take place

674
00:27:25,430 --> 00:27:23,440
once a century it might take place once

675
00:27:27,430 --> 00:27:25,440
in a thousand years

676
00:27:29,029 --> 00:27:27,440
it's rare

677
00:27:31,110 --> 00:27:29,039
but with something taking place that

678
00:27:33,510 --> 00:27:31,120
infrequently it could have happened last

679
00:27:36,710 --> 00:27:33,520
year it could have happened 15 months

680
00:27:38,549 --> 00:27:36,720
ago if it had happened last year galileo

681
00:27:40,070 --> 00:27:38,559
was far too was not in the right

682
00:27:41,750 --> 00:27:40,080
position to observe it we would have

683
00:27:44,230 --> 00:27:41,760
seen nothing

684
00:27:46,870 --> 00:27:44,240
if it had happened

685
00:27:49,350 --> 00:27:46,880
maybe

686
00:27:50,950 --> 00:27:49,360
last november we wouldn't have seen as

687
00:27:53,029 --> 00:27:50,960
much as we're getting now

688
00:27:55,350 --> 00:27:53,039

it's happening tonight

689
00:27:57,269 --> 00:27:55,360
we have a fully repaired and healthy

690
00:27:59,669 --> 00:27:57,279
hubble space telescope

691
00:28:01,990 --> 00:27:59,679
which has been performing like a jewel

692
00:28:05,110 --> 00:28:02,000
in the last few months the galileo

693
00:28:07,750 --> 00:28:05,120
spacecraft despite the antenna is

694
00:28:10,470 --> 00:28:07,760
producing fabulous discoveries the moon

695
00:28:12,070 --> 00:28:10,480
on the asteroid ida the moon circling

696
00:28:13,669 --> 00:28:12,080
ida is one of them

697
00:28:14,630 --> 00:28:13,679
this is a time

698
00:28:18,070 --> 00:28:14,640
when

699
00:28:20,950 --> 00:28:18,080
we can really look back and say

700
00:28:24,310 --> 00:28:20,960
the 25th anniversary of the moon landing

701
00:28:26,630 --> 00:28:24,320
is a real time to celebrate because we

702
00:28:29,269 --> 00:28:26,640
have such good instruments

703
00:28:31,750 --> 00:28:29,279
to observe the most fantastic event that

704
00:28:34,630 --> 00:28:31,760
we've had in a long time

705
00:28:38,070 --> 00:28:34,640
this is an event i think that has the

706
00:28:40,310 --> 00:28:38,080
power to generate a whole lot of

707
00:28:42,070 --> 00:28:40,320
interest in science among people

708
00:28:43,669 --> 00:28:42,080
especially young people

709
00:28:44,549 --> 00:28:43,679
people have asked me more than any other

710
00:28:46,310 --> 00:28:44,559
question

711
00:28:48,630 --> 00:28:46,320
what will this event do to us on earth

712
00:28:51,029 --> 00:28:48,640
and i start by saying absolutely no

713
00:28:53,430 --> 00:28:51,039

effect on earth jupiter is 500 million

714
00:28:55,510 --> 00:28:53,440
miles from here don't worry about it and

715
00:28:57,669 --> 00:28:55,520
then i think about it for a minute i

716
00:28:58,389 --> 00:28:57,679
hope this event has a powerful effect on

717
00:29:00,630 --> 00:28:58,399
earth

718
00:29:02,389 --> 00:29:00,640
i hope this event will make people think

719
00:29:04,950 --> 00:29:02,399
that the sky

720
00:29:05,990 --> 00:29:04,960
is a wonderful user-friendly place to to

721
00:29:09,669 --> 00:29:06,000
watch

722
00:29:12,789 --> 00:29:09,679
and that science is not just done by

723
00:29:14,230 --> 00:29:12,799
professional scientists science is fun

724
00:29:15,830 --> 00:29:14,240
it is alive

725
00:29:18,149 --> 00:29:15,840
it is telling us things that are

726
00:29:18,870 --> 00:29:18,159
important in the here and now

727
00:29:21,830 --> 00:29:18,880
if

728
00:29:23,350 --> 00:29:21,840
sl9s crash into jupiter does that i

729
00:29:25,269 --> 00:29:23,360
think it would really have made the best

730
00:29:26,630 --> 00:29:25,279
contribution of all

731
00:29:28,630 --> 00:29:26,640
and now dawn

732
00:29:30,230 --> 00:29:28,640
thank you i'd like to open up now to

733
00:29:31,590 --> 00:29:30,240
question an audience questions and

734
00:29:34,389 --> 00:29:31,600
answers from the audience here and then

735
00:29:36,789 --> 00:29:34,399
we'll take a q a from the nasa centers

736
00:29:38,389 --> 00:29:36,799
uh i would like for reporters to please

737
00:29:41,190 --> 00:29:38,399
wait for the microphone to get to you

738
00:29:48,149 --> 00:29:41,200

and then state your name and affiliation

739
00:29:52,710 --> 00:29:49,430
i think it is a little bit too early to

740
00:29:55,110 --> 00:29:52,720
ask you about this but how deep was the

741
00:29:57,909 --> 00:29:55,120
collision and the what was the uh how

742
00:29:58,710 --> 00:29:57,919
the energy energy looked like and

743
00:29:59,750 --> 00:29:58,720
from

744
00:30:05,269 --> 00:29:59,760
this

745
00:30:06,789 --> 00:30:05,279
comet look like it's look like asteroid

746
00:30:09,350 --> 00:30:06,799
oh it's look like a snowball or

747
00:30:13,590 --> 00:30:09,360
something can i ask your estimate i

748
00:30:19,510 --> 00:30:17,669
the first question was how deep did the

749
00:30:21,909 --> 00:30:19,520
comet penetrate into the atmosphere of

750
00:30:24,549 --> 00:30:21,919
jupiter well of course we don't know

751
00:30:26,470 --> 00:30:24,559
that yet for nucleus a

752
00:30:29,269 --> 00:30:26,480
for the simulation that i showed you

753
00:30:32,789 --> 00:30:29,279
this was for a one kilometer diameter

754
00:30:34,710 --> 00:30:32,799
uh body with the density of ice

755
00:30:37,510 --> 00:30:34,720
and it was

756
00:30:39,269 --> 00:30:37,520
essentially uh decided

757
00:30:40,789 --> 00:30:39,279
using what knowledge we have of the

758
00:30:43,510 --> 00:30:40,799
fragility

759
00:30:44,310 --> 00:30:43,520
of of the comet when it broke up

760
00:30:46,789 --> 00:30:44,320
that

761
00:30:50,310 --> 00:30:46,799
you know we would have it come apart

762
00:30:52,470 --> 00:30:50,320
at 31 kilometers below the cloud tops

763
00:30:54,950 --> 00:30:52,480

that's a somewhat arbitrary decision but

764
00:30:56,630 --> 00:30:54,960
we think it's fairly representative

765
00:30:58,789 --> 00:30:56,640
but we did let the comet go right

766
00:31:00,950 --> 00:30:58,799
through and stay intact

767
00:31:02,710 --> 00:31:00,960
punching a tunnel into the atmosphere on

768
00:31:04,310 --> 00:31:02,720
the computer of course

769
00:31:06,710 --> 00:31:04,320
and then it and then it comes apart and

770
00:31:08,789 --> 00:31:06,720
dumps its energy and creates a very hot

771
00:31:10,950 --> 00:31:08,799
fireball that expands and then rises

772
00:31:13,430 --> 00:31:10,960
buoyantly if you were to watch the

773
00:31:15,750 --> 00:31:13,440
evolution of the plume part of it does

774
00:31:17,590 --> 00:31:15,760
shoot back out along the tunnel but most

775
00:31:20,630 --> 00:31:17,600
of it just rises buoyantly and just

776
00:31:22,230 --> 00:31:20,640
bursts right out above the cloud tops

777
00:31:24,549 --> 00:31:22,240
so i think that's the answer to the

778
00:31:25,590 --> 00:31:24,559
first question now the second question

779
00:31:29,350 --> 00:31:25,600
was

780
00:31:30,549 --> 00:31:29,360
is this more like an asteroid or

781
00:31:32,230 --> 00:31:30,559
a listener

782
00:31:34,470 --> 00:31:32,240
or maybe you're asking is it a single

783
00:31:36,549 --> 00:31:34,480
solid object or is it an accumulation of

784
00:31:38,230 --> 00:31:36,559
many smaller pieces is that is that your

785
00:31:44,470 --> 00:31:38,240
question

786
00:31:47,350 --> 00:31:44,480
uh there are two very important reports

787
00:31:49,909 --> 00:31:47,360
one has just been published in nature

788
00:31:51,750 --> 00:31:49,919

and the second one has been submitted

789
00:31:52,630 --> 00:31:51,760
by an author who's here in this room i

790
00:31:55,350 --> 00:31:52,640
think

791
00:31:58,870 --> 00:31:55,360
i don't see him just this moment

792
00:32:01,909 --> 00:31:58,880
both showing that you can explain

793
00:32:03,669 --> 00:32:01,919
the number of objects that we see in the

794
00:32:06,389 --> 00:32:03,679
string of pearls

795
00:32:09,590 --> 00:32:06,399
if the original parent body was simply a

796
00:32:10,789 --> 00:32:09,600
loose agglomeration of many many smaller

797
00:32:13,029 --> 00:32:10,799
bodies

798
00:32:15,990 --> 00:32:13,039
and it and theoretically it turns out

799
00:32:18,470 --> 00:32:16,000
you should get just about 20 pieces

800
00:32:21,029 --> 00:32:18,480
when it breaks up and then and then

801
00:32:23,909 --> 00:32:21,039
20 individual clumps but each clump

802
00:32:26,310 --> 00:32:23,919
itself is made of many smaller pieces

803
00:32:29,110 --> 00:32:26,320
uh this is this looks like a very

804
00:32:30,070 --> 00:32:29,120
reasonable proposition

805
00:32:30,950 --> 00:32:30,080
and

806
00:32:32,310 --> 00:32:30,960
in fact

807
00:32:33,830 --> 00:32:32,320
is redick here

808
00:32:36,070 --> 00:32:33,840
i don't see him at the moment he's here

809
00:32:37,990 --> 00:32:36,080
at the space shuttle science institute

810
00:32:40,630 --> 00:32:38,000
and the other and the other authors are

811
00:32:41,990 --> 00:32:40,640
by ashfog and bentz who published in

812
00:32:43,430 --> 00:32:42,000
nature

813
00:32:46,470 --> 00:32:43,440

i think it's a very

814
00:32:48,950 --> 00:32:46,480
very persuading argument

815
00:32:51,190 --> 00:32:48,960
in fact i would venture to say that a

816
00:32:52,789 --> 00:32:51,200
general view of comets is in in the

817
00:32:54,630 --> 00:32:52,799
process of shift i think we're going to

818
00:32:56,149 --> 00:32:54,640
see a paradigm shift

819
00:32:58,230 --> 00:32:56,159
from the point of view where people have

820
00:33:00,470 --> 00:32:58,240
been thinking of comets as sort of one

821
00:33:02,789 --> 00:33:00,480
big dirty snowball

822
00:33:05,909 --> 00:33:02,799
to really just a collection of finer

823
00:33:07,590 --> 00:33:05,919
debris just loosely held by gravity

824
00:33:08,870 --> 00:33:07,600
uh i think a lot of people are now

825
00:33:10,389 --> 00:33:08,880
starting to think very much in that

826
00:33:12,070 --> 00:33:10,399
direction and the evidence is coming of

827
00:33:17,029 --> 00:33:12,080
course from the breakup of periodic

828
00:33:21,669 --> 00:33:18,470
for reuters

829
00:33:23,269 --> 00:33:21,679
have any of you seen any images of the

830
00:33:25,029 --> 00:33:23,279
impact site

831
00:33:26,630 --> 00:33:25,039
if you have what were you looking for

832
00:33:29,029 --> 00:33:26,640
and what did you see have you seen

833
00:33:31,750 --> 00:33:29,039
anything from hubble yet if you haven't

834
00:33:34,470 --> 00:33:31,760
when are you going to see it

835
00:33:37,269 --> 00:33:34,480
well let me answer for the for the team

836
00:33:39,430 --> 00:33:37,279
uh stick around till 10.

837
00:33:41,430 --> 00:33:39,440
we've not seen the images yet

838
00:33:43,029 --> 00:33:41,440

they're coming down and heidi hamill

839
00:33:45,350 --> 00:33:43,039
will report on that

840
00:33:47,830 --> 00:33:45,360
uh in about two hours

841
00:33:50,070 --> 00:33:47,840
one one quick follow-up what will you be

842
00:33:51,750 --> 00:33:50,080
looking for when you see these images i

843
00:33:52,389 --> 00:33:51,760
know you have that model that you showed

844
00:33:53,110 --> 00:33:52,399
us

845
00:33:54,470 --> 00:33:53,120
but

846
00:33:56,230 --> 00:33:54,480
what what are you going to be looking

847
00:33:58,950 --> 00:33:56,240
most assiduously for when you see those

848
00:34:01,350 --> 00:33:58,960
images from hubble

849
00:34:04,070 --> 00:34:01,360
a new spot

850
00:34:05,430 --> 00:34:04,080
on on jupiter and in fact i don't know

851
00:34:07,830 --> 00:34:05,440
if i mentioned it

852
00:34:12,310 --> 00:34:07,840
the the intensity of the brightness of

853
00:34:18,869 --> 00:34:15,510
from color alto and granada

854
00:34:21,270 --> 00:34:18,879
was greater than the brightness of eu

855
00:34:23,190 --> 00:34:21,280
in the 2.3 micron van

856
00:34:24,710 --> 00:34:23,200
uh where i hope very much that the

857
00:34:26,869 --> 00:34:24,720
hubble images that are going to be seen

858
00:34:29,030 --> 00:34:26,879
later tonight will actually define the

859
00:34:31,270 --> 00:34:29,040
dimensions and the brightness of that

860
00:34:33,270 --> 00:34:31,280
spot in various wavelengths very well so

861
00:34:35,829 --> 00:34:33,280
this is very exciting stay tuned none of

862
00:34:37,829 --> 00:34:35,839
us up here have seen those images yet

863
00:34:39,589 --> 00:34:37,839

see could you uh put your mic down just

864
00:34:41,270 --> 00:34:39,599
a little bit

865
00:34:42,869 --> 00:34:41,280
okay question romero from sky and

866
00:34:45,829 --> 00:34:42,879
telescope

867
00:34:47,829 --> 00:34:45,839
uh brian marsden recently mentioned that

868
00:34:49,829 --> 00:34:47,839
he thought that such impacts probably

869
00:34:51,909 --> 00:34:49,839
happened the order of decades

870
00:34:53,510 --> 00:34:51,919
given the uh this recent observation of

871
00:34:55,589 --> 00:34:53,520
this small fragment

872
00:35:01,109 --> 00:34:55,599
do you think that that's possible that

873
00:35:04,870 --> 00:35:03,109
do you want to answer david

874
00:35:06,310 --> 00:35:04,880
it's hard to say i haven't i haven't

875
00:35:08,550 --> 00:35:06,320
seen

876
00:35:10,470 --> 00:35:08,560
based on a previous question i i i

877
00:35:12,790 --> 00:35:10,480
haven't seen the pictures yet based on

878
00:35:14,710 --> 00:35:12,800
the descriptions

879
00:35:16,470 --> 00:35:14,720
uh that we've read

880
00:35:18,710 --> 00:35:16,480
it's looking really

881
00:35:20,630 --> 00:35:18,720
like fragment a fragment a is one of the

882
00:35:21,589 --> 00:35:20,640
smaller fragments one of the smallest

883
00:35:23,990 --> 00:35:21,599
ones

884
00:35:25,910 --> 00:35:24,000
and its importance is only in that it's

885
00:35:29,030 --> 00:35:25,920
the first one and

886
00:35:32,710 --> 00:35:29,040
if it has really produced so far based

887
00:35:34,870 --> 00:35:32,720
on ground-based images what what it what

888
00:35:37,670 --> 00:35:34,880

it seems to have produced it's looking

889
00:35:39,910 --> 00:35:37,680
like these the original comet would have

890
00:35:42,950 --> 00:35:39,920
been closer to the larger

891
00:35:45,589 --> 00:35:42,960
size the larger end closer to that

892
00:35:48,390 --> 00:35:45,599
10 kilometer diameter for the original

893
00:35:51,750 --> 00:35:48,400
body it's still too early to say that

894
00:35:53,190 --> 00:35:51,760
for sure but if that's the case then i

895
00:35:55,270 --> 00:35:53,200
would suggest

896
00:35:57,030 --> 00:35:55,280
that this would be a much rarer event

897
00:35:58,710 --> 00:35:57,040
than that maybe once every several

898
00:36:00,630 --> 00:35:58,720
hundred maybe a thousand years what do

899
00:36:03,829 --> 00:36:00,640
you think my best guess is if the

900
00:36:05,670 --> 00:36:03,839
precursor were 10 kilometers across and

901
00:36:08,230 --> 00:36:05,680
the fact that we're seeing such a bright

902
00:36:09,910 --> 00:36:08,240
spot if these reports are correct i have

903
00:36:11,349 --> 00:36:09,920
to be a caveat there we have to get

904
00:36:12,790 --> 00:36:11,359
that's a big yes

905
00:36:14,950 --> 00:36:12,800
these reports are correct and i think

906
00:36:17,270 --> 00:36:14,960
the 10 kilometer size as david says

907
00:36:19,349 --> 00:36:17,280
looks reasonable and my guess is that

908
00:36:21,109 --> 00:36:19,359
you don't get a hit by a 10 kilometer

909
00:36:22,710 --> 00:36:21,119
object more frequently than about once a

910
00:36:24,310 --> 00:36:22,720
thousand years i think we may be

911
00:36:25,910 --> 00:36:24,320
privileged to witness one of those very

912
00:36:28,470 --> 00:36:25,920
rare events in australia and there's

913
00:36:30,550 --> 00:36:28,480

there's something else though um this is

914
00:36:32,230 --> 00:36:30,560
the second act of the two-act play well

915
00:36:34,710 --> 00:36:32,240
it's the second activist play that is at

916
00:36:36,870 --> 00:36:34,720
least 2x so far

917
00:36:39,270 --> 00:36:36,880
this is the number this is the frequency

918
00:36:41,510 --> 00:36:39,280
for just an impact

919
00:36:43,510 --> 00:36:41,520
what is the frequency for the comet to

920
00:36:45,990 --> 00:36:43,520
do this weird celestial dance around

921
00:36:48,150 --> 00:36:46,000
jupiter breaking up two years before

922
00:36:49,990 --> 00:36:48,160
impact brightening up so that it could

923
00:36:51,589 --> 00:36:50,000
be discovered and we could plan for this

924
00:36:53,670 --> 00:36:51,599
thing

925
00:36:56,150 --> 00:36:53,680
would how do we factor that into the

926
00:36:58,069 --> 00:36:56,160
equation that makes it still more rare

927
00:36:59,829 --> 00:36:58,079
i i think there's one other factor and

928
00:37:02,310 --> 00:36:59,839
that is that you could have an event

929
00:37:03,750 --> 00:37:02,320
like that on jupiter but if no one is

930
00:37:06,230 --> 00:37:03,760
looking

931
00:37:08,950 --> 00:37:06,240
you're not going to see it

932
00:37:10,390 --> 00:37:08,960
jupiter is not always the center of

933
00:37:11,190 --> 00:37:10,400
attention

934
00:37:15,910 --> 00:37:11,200
and

935
00:37:17,990 --> 00:37:15,920
at the right time

936
00:37:19,670 --> 00:37:18,000
you might you might you saw the

937
00:37:21,750 --> 00:37:19,680
simulation

938
00:37:25,829 --> 00:37:21,760

that dies down fairly quickly you might

939
00:37:27,750 --> 00:37:25,839
not notice another white spot very soon

940
00:37:30,470 --> 00:37:27,760
but this is prim this is a little

941
00:37:33,349 --> 00:37:30,480
premature we haven't we haven't seen the

942
00:37:35,990 --> 00:37:33,359
data from hubble space telescope

943
00:37:38,390 --> 00:37:36,000
we're basing this on two initial reports

944
00:37:41,430 --> 00:37:38,400
and they're reliable reports

945
00:37:44,390 --> 00:37:41,440
but it's it's there's that big caveat we

946
00:37:45,829 --> 00:37:44,400
want to see more we all want to see more

947
00:37:48,069 --> 00:37:45,839
uh but it's looking pretty good right

948
00:37:50,230 --> 00:37:48,079
now that we're seeing a rare rare event

949
00:37:52,390 --> 00:37:50,240
i just make one other comment steve and

950
00:37:54,390 --> 00:37:52,400
that is that you know i think martin was

951
00:37:55,829 --> 00:37:54,400
arguing simply from a probabilistic

952
00:37:58,470 --> 00:37:55,839
standpoint you know what are the odds

953
00:37:59,430 --> 00:37:58,480
that we would be lucky enough like tycho

954
00:38:03,510 --> 00:37:59,440
to see

955
00:38:05,750 --> 00:38:03,520
the once per millennium uh supernova uh

956
00:38:07,109 --> 00:38:05,760
the odds uh priori odds are this that

957
00:38:09,109 --> 00:38:07,119
we're if we're going to see something at

958
00:38:10,069 --> 00:38:09,119
all it's much more frequent

959
00:38:13,349 --> 00:38:10,079
and

960
00:38:16,310 --> 00:38:13,359
impact of say something

961
00:38:18,230 --> 00:38:16,320
like a one or two kilometer body

962
00:38:19,430 --> 00:38:18,240
or a parent body rather than a 10

963
00:38:22,630 --> 00:38:19,440

kilometer

964
00:38:27,109 --> 00:38:24,230
since jupiter

965
00:38:28,790 --> 00:38:27,119
name and affiliation oh sorry uh linda

966
00:38:31,510 --> 00:38:28,800
howe uh chancellor communications

967
00:38:34,630 --> 00:38:31,520
philadelphia since jupiter is a planet

968
00:38:37,270 --> 00:38:34,640
that is largely made of hydrogen gas

969
00:38:41,510 --> 00:38:37,280
what prevents the large plume explosions

970
00:38:46,710 --> 00:38:43,670
well i can try that

971
00:38:48,310 --> 00:38:46,720
hydrogen as as we know is very flammable

972
00:38:51,430 --> 00:38:48,320
but you need oxygen

973
00:38:53,430 --> 00:38:51,440
to uh to keep the combustion going and

974
00:38:56,230 --> 00:38:53,440
jupiter the hydrogen is just there all

975
00:38:58,470 --> 00:38:56,240
by itself just sitting there very cold

976
00:39:00,550 --> 00:38:58,480
and it says inert as

977
00:39:01,990 --> 00:39:00,560
stale bread

978
00:39:03,990 --> 00:39:02,000
as

979
00:39:05,589 --> 00:39:04,000
so i don't think

980
00:39:10,390 --> 00:39:05,599
i

981
00:39:14,870 --> 00:39:13,349
because so many people watch 2010 these

982
00:39:18,150 --> 00:39:14,880
days

983
00:39:20,390 --> 00:39:18,160
these comets are far too small

984
00:39:23,030 --> 00:39:20,400
by many orders of magnitude

985
00:39:24,950 --> 00:39:23,040
to start any nuclear fusion from taking

986
00:39:27,109 --> 00:39:24,960
place inside jupiter that's not what

987
00:39:29,589 --> 00:39:27,119
this is about at all

988
00:39:31,750 --> 00:39:29,599

um jupiter is not going to catch on fire

989
00:39:33,190 --> 00:39:31,760
there's no oxygen to support that did i

990
00:39:34,710 --> 00:39:33,200
do okay

991
00:39:35,910 --> 00:39:34,720
i'm not was that the sense of your

992
00:39:36,790 --> 00:39:35,920
question

993
00:39:38,790 --> 00:39:36,800
well

994
00:39:40,390 --> 00:39:38,800
any kind of explo it could be either way

995
00:39:42,550 --> 00:39:40,400
i wasn't thinking necessarily of a

996
00:39:44,630 --> 00:39:42,560
nuclear explosion like a sun but just

997
00:39:46,790 --> 00:39:44,640
what would keep the hydrogen from

998
00:39:47,750 --> 00:39:46,800
continuing to explode and explode if

999
00:39:49,190 --> 00:39:47,760
they are

1000
00:39:50,950 --> 00:39:49,200
going to be massive as you've

1001
00:39:51,990 --> 00:39:50,960
demonstrated here why wouldn't it just

1002
00:39:53,829 --> 00:39:52,000
keep

1003
00:39:55,589 --> 00:39:53,839
exploding with more and more hydrogen

1004
00:39:58,150 --> 00:39:55,599
bear in mind what's happening it's not

1005
00:40:00,150 --> 00:39:58,160
that the hydrogen is burning or

1006
00:40:02,230 --> 00:40:00,160
that sort of thing it's just that a

1007
00:40:04,790 --> 00:40:02,240
tremendous amount of energy

1008
00:40:07,109 --> 00:40:04,800
is dumped into the atmosphere of jupiter

1009
00:40:09,750 --> 00:40:07,119
by a very strong shock wave

1010
00:40:11,270 --> 00:40:09,760
which heats the atmosphere up to several

1011
00:40:13,349 --> 00:40:11,280
tens of

1012
00:40:16,150 --> 00:40:13,359
thousands of degrees kelvin

1013
00:40:18,150 --> 00:40:16,160

so it's exceedingly hot in

1014
00:40:20,069 --> 00:40:18,160
in a very small region that's simply

1015
00:40:22,390 --> 00:40:20,079
because you have a body coming in at 60

1016
00:40:24,310 --> 00:40:22,400
kilometers per second in a very short

1017
00:40:25,270 --> 00:40:24,320
distance releases all of its kinetic

1018
00:40:27,190 --> 00:40:25,280
energy

1019
00:40:28,870 --> 00:40:27,200
uh so all you're really doing is just

1020
00:40:30,470 --> 00:40:28,880
you're point heating almost the

1021
00:40:32,550 --> 00:40:30,480
atmosphere

1022
00:40:34,550 --> 00:40:32,560
and what causes the eruption the plume

1023
00:40:36,870 --> 00:40:34,560
is that that just expands

1024
00:40:41,109 --> 00:40:36,880
and and becomes a buoyant bubble that

1025
00:40:41,119 --> 00:40:46,390
second option

1026
00:40:50,069 --> 00:40:48,470
shoemaker glenda chu from the san jose

1027
00:40:51,910 --> 00:40:50,079
mercury news i wonder if you could

1028
00:40:53,670 --> 00:40:51,920
repeat the bit of news that you had this

1029
00:40:55,829 --> 00:40:53,680
evening about the two observatories that

1030
00:40:57,190 --> 00:40:55,839
actually think they have spotted plumes

1031
00:40:58,950 --> 00:40:57,200
where are those and what are the names

1032
00:41:00,309 --> 00:40:58,960
of them and if you could spell them it'd

1033
00:41:01,990 --> 00:41:00,319
be all for the better

1034
00:41:03,670 --> 00:41:02,000
and and the names of the scientists were

1035
00:41:05,270 --> 00:41:03,680
in charge there i could give those to

1036
00:41:07,430 --> 00:41:05,280
you yes

1037
00:41:10,390 --> 00:41:07,440
the first report that was received was

1038
00:41:13,270 --> 00:41:10,400

from calar alto which is in granada

1039
00:41:17,030 --> 00:41:13,280
spain c-a-l-a-r

1040
00:41:23,510 --> 00:41:20,950
the observers were tom herbst

1041
00:41:26,710 --> 00:41:23,520
h-e-r-b-s-t

1042
00:41:26,720 --> 00:41:30,790
jose ortiz

1043
00:41:33,750 --> 00:41:32,230
hermann

1044
00:41:37,510 --> 00:41:33,760
buhart

1045
00:41:40,550 --> 00:41:37,520
i have it down as b o e h h a b o yes b

1046
00:41:42,230 --> 00:41:40,560
o e h h a r d t i hope i transcribed it

1047
00:41:45,030 --> 00:41:42,240
correctly

1048
00:41:48,150 --> 00:41:45,040
uh carl heinz mandel

1049
00:41:55,829 --> 00:41:51,030
mandel m-a-n-d-e-l

1050
00:42:00,950 --> 00:41:57,910
and that's for they are observing at

1051
00:42:03,750 --> 00:42:00,960
calar alto spain

1052
00:42:06,950 --> 00:42:03,760
the second report this is from a 3.5

1053
00:42:09,430 --> 00:42:06,960
meter telescope it's a big telescope

1054
00:42:12,390 --> 00:42:09,440
the second report is from the nordic

1055
00:42:13,990 --> 00:42:12,400
optical telescope at la cia

1056
00:42:16,710 --> 00:42:14,000
chile

1057
00:42:18,230 --> 00:42:16,720
the report was relayed on by richard

1058
00:42:20,309 --> 00:42:18,240
west

1059
00:42:22,470 --> 00:42:20,319
of the european southern observatory but

1060
00:42:24,630 --> 00:42:22,480
i do not have information on who the

1061
00:42:26,710 --> 00:42:24,640
actual observers were

1062
00:42:30,230 --> 00:42:26,720
i'm sure that that will become public

1063
00:42:30,240 --> 00:42:37,990

two words l-a-n-s-i-l-l-a

1064
00:42:38,000 --> 00:42:42,230
pardon me

1065
00:42:47,510 --> 00:42:45,190
the time reported from calar alto the

1066
00:42:52,950 --> 00:42:47,520
plume was observed at

1067
00:42:58,790 --> 00:42:55,670
versus a predicted impact time

1068
00:42:59,670 --> 00:42:58,800
of 20 hours even

1069
00:43:00,390 --> 00:42:59,680
by

1070
00:43:04,069 --> 00:43:00,400
the

1071
00:43:06,630 --> 00:43:04,079
jpl team of paul chodes and don yumans

1072
00:43:08,870 --> 00:43:06,640
that means that the uh the predictions

1073
00:43:11,670 --> 00:43:08,880
from chodes and yeomans were really very

1074
00:43:13,990 --> 00:43:11,680
they're very good extremely uh take one

1075
00:43:16,550 --> 00:43:14,000
more question from here go to one of the

1076
00:43:19,190 --> 00:43:16,560
centers and then come back

1077
00:43:21,349 --> 00:43:19,200
it's an uh nhk

1078
00:43:24,470 --> 00:43:21,359
um at ten o'clock we're expecting images

1079
00:43:26,069 --> 00:43:24,480
in the visible light range from hubble

1080
00:43:28,710 --> 00:43:26,079
and uh we're curious about some of the

1081
00:43:31,510 --> 00:43:28,720
other uh areas that have been explored

1082
00:43:34,069 --> 00:43:31,520
in terms of the spectrum

1083
00:43:36,870 --> 00:43:34,079
have you heard of reports from uh

1084
00:43:39,589 --> 00:43:36,880
in the infrared range ultraviolet

1085
00:43:44,150 --> 00:43:39,599
uh even perhaps

1086
00:43:50,470 --> 00:43:47,109
there has been a report that's come over

1087
00:43:53,030 --> 00:43:50,480
the news wires from japan

1088
00:43:53,040 --> 00:43:57,030

let's see miles here

1089
00:44:01,589 --> 00:43:59,190
don't see it

1090
00:44:03,589 --> 00:44:01,599
this is a report uh by the japanese

1091
00:44:04,550 --> 00:44:03,599
observer not familiar to me in the radio

1092
00:44:07,109 --> 00:44:04,560
region

1093
00:44:10,309 --> 00:44:07,119
reporting and and it's not specified as

1094
00:44:13,190 --> 00:44:10,319
to the wavelength region

1095
00:44:15,349 --> 00:44:13,200
that the radio emission from jupiter

1096
00:44:18,069 --> 00:44:15,359
this is already before the impact of

1097
00:44:20,829 --> 00:44:18,079
fragment a it's about a day ago

1098
00:44:24,069 --> 00:44:20,839
it increased by a factor between 10 and

1099
00:44:25,750 --> 00:44:24,079
100. but we i've not seen any details on

1100
00:44:27,430 --> 00:44:25,760
that so that's the only thing i know of

1101
00:44:29,750 --> 00:44:27,440
in the radio region

1102
00:44:32,309 --> 00:44:29,760
i expect we're going to see a lot of

1103
00:44:33,750 --> 00:44:32,319
reports coming in in the next 24 hours

1104
00:44:36,150 --> 00:44:33,760
from radio observers i'll be very

1105
00:44:38,790 --> 00:44:36,160
surprised if we don't see discrete

1106
00:44:40,870 --> 00:44:38,800
pulses from these impact events that's

1107
00:44:43,030 --> 00:44:40,880
all i know of at the present time so

1108
00:44:44,710 --> 00:44:43,040
actually we only knew of these things a

1109
00:44:46,790 --> 00:44:44,720
couple of hours ago so

1110
00:44:49,829 --> 00:44:46,800
it's all very fresh

1111
00:44:51,670 --> 00:44:49,839
i'd like to go to uh

1112
00:44:53,270 --> 00:44:51,680
me please we're going to have to take a

1113
00:44:55,270 --> 00:44:53,280

question from the johnson space center

1114
00:44:57,109 --> 00:44:55,280
now and we will come back to four more

1115
00:44:59,349 --> 00:44:57,119
questions here in a moment

1116
00:45:02,710 --> 00:44:59,359
johnson are you online

1117
00:45:05,349 --> 00:45:02,720
name an affiliation please this is

1118
00:45:06,230 --> 00:45:05,359
this is dan feldstein from the houston

1119
00:45:08,790 --> 00:45:06,240
post

1120
00:45:09,990 --> 00:45:08,800
and i was wondering uh you've heard the

1121
00:45:12,550 --> 00:45:10,000
two

1122
00:45:14,630 --> 00:45:12,560
reports that they have seen a plume

1123
00:45:17,510 --> 00:45:14,640
i was wondering have you heard from

1124
00:45:18,550 --> 00:45:17,520
people who were looking and did not see

1125
00:45:20,710 --> 00:45:18,560
anything

1126
00:45:22,710 --> 00:45:20,720
and have you gotten many of those or

1127
00:45:28,230 --> 00:45:22,720
could you characterize how many folks

1128
00:45:32,630 --> 00:45:30,309
i've only heard about fourth hand that

1129
00:45:34,230 --> 00:45:32,640
people have tried to observe in the

1130
00:45:37,190 --> 00:45:34,240
visible region of spectrum without

1131
00:45:39,589 --> 00:45:37,200
success but i have no re no real reason

1132
00:45:40,550 --> 00:45:39,599
to believe that that's strongly

1133
00:45:42,790 --> 00:45:40,560
uh

1134
00:45:45,670 --> 00:45:42,800
based i just don't know yeah we we just

1135
00:45:48,390 --> 00:45:45,680
checked the email just before coming

1136
00:45:50,309 --> 00:45:48,400
here and there didn't seem the only two

1137
00:45:52,630 --> 00:45:50,319
reports we got were those two positive

1138
00:45:54,710 --> 00:45:52,640

ones we did not get any negative

1139
00:45:56,150 --> 00:45:54,720
any negative ones i know that some of

1140
00:45:58,150 --> 00:45:56,160
the sites did report that they were

1141
00:45:59,990 --> 00:45:58,160
cloudy

1142
00:46:02,230 --> 00:46:00,000
but we i haven't received any other

1143
00:46:03,910 --> 00:46:02,240
reports

1144
00:46:06,069 --> 00:46:03,920
we'll uh take one question from jet

1145
00:46:08,470 --> 00:46:06,079
propulsion laboratory in california go

1146
00:46:10,309 --> 00:46:08,480
ahead please name an affiliation

1147
00:46:12,829 --> 00:46:10,319
uh this is robert lee host of the los

1148
00:46:15,670 --> 00:46:12,839
angeles times i wonder if you could tell

1149
00:46:17,829 --> 00:46:15,680
us based on the sketchy preliminary

1150
00:46:19,910 --> 00:46:17,839
observations that you've had reports on

1151
00:46:21,910 --> 00:46:19,920
whether the plumes that were observed

1152
00:46:23,910 --> 00:46:21,920
bear any resemblance to

1153
00:46:28,630 --> 00:46:23,920
that interesting simulation you just ran

1154
00:46:33,829 --> 00:46:31,510
well my interpretation and this is

1155
00:46:35,349 --> 00:46:33,839
really you have to be very careful now

1156
00:46:36,870 --> 00:46:35,359
because we're working with very little

1157
00:46:40,309 --> 00:46:36,880
information

1158
00:46:42,550 --> 00:46:40,319
uh but in order for the plume to be seen

1159
00:46:45,190 --> 00:46:42,560
at all

1160
00:46:48,550 --> 00:46:45,200
it has to be in fact at the time given

1161
00:46:49,349 --> 00:46:48,560
it would be very near the limb

1162
00:46:50,790 --> 00:46:49,359
and

1163
00:46:52,710 --> 00:46:50,800

i think it would

1164
00:46:55,349 --> 00:46:52,720
he would be very consistent with the

1165
00:46:57,430 --> 00:46:55,359
simulation that i showed

1166
00:47:00,710 --> 00:46:57,440
to have a plume rising

1167
00:47:02,630 --> 00:47:00,720
up to about a thousand kilometers above

1168
00:47:04,870 --> 00:47:02,640
the limb

1169
00:47:07,030 --> 00:47:04,880
to be visible and to be as bright as it

1170
00:47:10,790 --> 00:47:07,040
was reported but we've got to see lots

1171
00:47:13,990 --> 00:47:12,550
you know follow up at jpl then we'll

1172
00:47:24,470 --> 00:47:14,000
come back here to this telescope

1173
00:47:28,550 --> 00:47:25,990
am i up

1174
00:47:30,069 --> 00:47:28,560
go ahead yep this is alan mayerson from

1175
00:47:31,910 --> 00:47:30,079
national geographic magazine dr

1176
00:47:33,750 --> 00:47:31,920
schumacher you mentioned that article by

1177
00:47:36,069 --> 00:47:33,760
willie benz in nature

1178
00:47:37,670 --> 00:47:36,079
and the article said that um you know

1179
00:47:38,390 --> 00:47:37,680
that the comment wasn't supposed to be

1180
00:47:40,390 --> 00:47:38,400
one

1181
00:47:42,309 --> 00:47:40,400
um solid body but many fragments and i

1182
00:47:43,910 --> 00:47:42,319
just wonder whether or not the fact that

1183
00:47:46,390 --> 00:47:43,920
there have been two

1184
00:47:48,470 --> 00:47:46,400
two confirmations of the of the plume is

1185
00:47:49,510 --> 00:47:48,480
consistent with that theory that is to

1186
00:47:50,870 --> 00:47:49,520
say that

1187
00:47:53,510 --> 00:47:50,880
i thought the fact that if the comet

1188
00:47:55,430 --> 00:47:53,520

were made up of many smaller parts that

1189
00:47:57,349 --> 00:47:55,440
it would have just uh dissipated in the

1190
00:47:59,270 --> 00:47:57,359
atmosphere and not created a plume like

1191
00:48:04,710 --> 00:47:59,280
that

1192
00:48:07,670 --> 00:48:04,720
drawn by paul weissman in a commentary

1193
00:48:10,390 --> 00:48:07,680
on the article by askfog and benz

1194
00:48:11,910 --> 00:48:10,400
predicting the great fizzle

1195
00:48:13,829 --> 00:48:11,920
uh and if the reports that we've

1196
00:48:15,510 --> 00:48:13,839
received from spain and chile are

1197
00:48:18,309 --> 00:48:15,520
correct

1198
00:48:19,349 --> 00:48:18,319
it's not a great fizzle

1199
00:48:21,109 --> 00:48:19,359
so

1200
00:48:22,390 --> 00:48:21,119
you have to remember that

1201
00:48:25,430 --> 00:48:22,400
this the

1202
00:48:26,870 --> 00:48:25,440
work by asphalt and benz does not say

1203
00:48:29,430 --> 00:48:26,880
whether

1204
00:48:31,109 --> 00:48:29,440
the p the small pieces are successfully

1205
00:48:33,589 --> 00:48:31,119
all re-aggregated into sort of

1206
00:48:36,309 --> 00:48:33,599
essentially one clump for each nucleus

1207
00:48:38,950 --> 00:48:36,319
or whether they're spread out

1208
00:48:40,630 --> 00:48:38,960
but i would i think that

1209
00:48:42,870 --> 00:48:40,640
the plume is reported as certainly

1210
00:48:45,270 --> 00:48:42,880
consistent with these smaller pieces

1211
00:48:47,430 --> 00:48:45,280
re-aggregating in into one clump that's

1212
00:48:48,390 --> 00:48:47,440
what effectively hits the top of the

1213
00:48:49,990 --> 00:48:48,400

atmosphere

1214
00:48:53,030 --> 00:48:50,000
one thing i would say is that

1215
00:48:54,950 --> 00:48:53,040
we if we should see these things at all

1216
00:48:57,589 --> 00:48:54,960
that it probably indicates we're dealing

1217
00:49:00,470 --> 00:48:57,599
with larger objects than was re then was

1218
00:49:11,030 --> 00:49:00,480
concluded by us fog and benz and i think

1219
00:49:15,829 --> 00:49:14,230
i'd like to introduce dr heidi hamill

1220
00:49:19,589 --> 00:49:15,839
eugene schumacher said he would be

1221
00:49:20,390 --> 00:49:19,599
personally astonished if we saw nothing

1222
00:49:22,470 --> 00:49:20,400
well

1223
00:49:25,030 --> 00:49:22,480
or if we didn't see something

1224
00:49:28,630 --> 00:49:25,040
well he's not going to be astonished

1225
00:49:29,430 --> 00:49:28,640
we actually saw some amazing things

1226
00:49:33,829 --> 00:49:29,440
we

1227
00:49:36,309 --> 00:49:33,839
in the first orbit

1228
00:49:37,829 --> 00:49:36,319
we were able to see a plume on the edge

1229
00:49:40,790 --> 00:49:37,839
of the planet

1230
00:49:42,870 --> 00:49:40,800
in the second orbit which i have a raw

1231
00:49:44,470 --> 00:49:42,880
laser printer output this is as raw as

1232
00:49:46,390 --> 00:49:44,480
it gets

1233
00:49:49,589 --> 00:49:46,400
we can actually see the impact site

1234
00:49:52,790 --> 00:49:49,599
itself and i'll remind you this is for a

1235
00:49:54,230 --> 00:49:52,800
the first one not the brightest one

1236
00:49:55,829 --> 00:49:54,240
so we're going to have a really exciting

1237
00:49:57,990 --> 00:49:55,839
week

1238
00:49:59,990 --> 00:49:58,000

so more details to come we just got this

1239
00:50:01,589 --> 00:50:00,000
data down we haven't had a chance to do

1240
00:50:03,670 --> 00:50:01,599
anything with it and i'll be talking

1241
00:50:05,430 --> 00:50:03,680
with you at 10 o'clock about what we

1242
00:50:24,630 --> 00:50:05,440
have actually seen in the larger data

1243
00:50:29,589 --> 00:50:26,470
what's the wavelength heidi this is a

1244
00:50:33,990 --> 00:50:29,599
methane filter at 8.89 do you want a

1245
00:50:37,109 --> 00:50:35,510
i don't even have a piece of cardboard

1246
00:50:38,870 --> 00:50:37,119
to have this mounted on

1247
00:50:41,109 --> 00:50:38,880
okay we just blew up a section of the

1248
00:50:42,790 --> 00:50:41,119
planet this is the southern pole here

1249
00:50:44,309 --> 00:50:42,800
you see there's a little there's a

1250
00:50:48,069 --> 00:50:44,319
bright streak

1251
00:50:52,069 --> 00:50:48,079
edge of the street there's some other

1252
00:50:52,079 --> 00:51:20,549
tell you more about the stuff tonight

1253
00:51:27,270 --> 00:51:22,309
i think we may have some more questions

1254
00:51:31,109 --> 00:51:28,309
wow

1255
00:51:35,910 --> 00:51:33,109
well i think you can all lay your

1256
00:51:39,670 --> 00:51:35,920
worries to rest those reports from spain

1257
00:51:43,990 --> 00:51:41,910
and i think i think that we

1258
00:51:45,750 --> 00:51:44,000
i'll personally bet another case of

1259
00:51:49,030 --> 00:51:45,760
champagne with brian marsden that we've

1260
00:51:50,390 --> 00:51:49,040
got big objects those are not puny not

1261
00:51:51,910 --> 00:51:50,400
not to show that

1262
00:51:53,109 --> 00:51:51,920
to see the effects that we're seeing you

1263
00:51:56,549 --> 00:51:53,119

have to put a lot of energy into the

1264
00:51:58,470 --> 00:51:56,559
atmosphere so i i think we're very very

1265
00:52:00,549 --> 00:51:58,480
privileged tonight

1266
00:52:01,910 --> 00:52:00,559
to see an event that's that's not once

1267
00:52:04,549 --> 00:52:01,920
in a lifetime

1268
00:52:06,470 --> 00:52:04,559
it's it's once in a millennium i think

1269
00:52:09,270 --> 00:52:06,480
though that brian's

1270
00:52:11,910 --> 00:52:09,280
de bruyne marsden's efforts to

1271
00:52:13,910 --> 00:52:11,920
to come out on the smaller size

1272
00:52:15,750 --> 00:52:13,920
were great because we have had

1273
00:52:17,910 --> 00:52:15,760
experiences where there's been a lot of

1274
00:52:20,390 --> 00:52:17,920
hype for something and then it turns out

1275
00:52:22,230 --> 00:52:20,400
to be not what we're expecting

1276
00:52:24,470 --> 00:52:22,240
we've never seen this before this is

1277
00:52:25,910 --> 00:52:24,480
totally new ground this is a totally new

1278
00:52:27,750 --> 00:52:25,920
kind of thing in science that we're

1279
00:52:28,790 --> 00:52:27,760
witnessing tonight

1280
00:52:29,990 --> 00:52:28,800
and

1281
00:52:34,069 --> 00:52:30,000
brian

1282
00:52:36,470 --> 00:52:34,079
certainly made a lot of sense to me we

1283
00:52:37,430 --> 00:52:36,480
didn't buy it but it it made a lot of

1284
00:52:38,950 --> 00:52:37,440
sense

1285
00:52:40,870 --> 00:52:38,960
and um

1286
00:52:42,950 --> 00:52:40,880
i would imagine right now that brian's

1287
00:52:44,470 --> 00:52:42,960
as excited as the rest of us

1288
00:52:46,549 --> 00:52:44,480

at what is happening

1289
00:52:48,950 --> 00:52:46,559
this is this is a wonderful time for

1290
00:52:51,349 --> 00:52:48,960
everybody i think i i'd like to second

1291
00:52:53,349 --> 00:52:51,359
that david i think brian wanted to be on

1292
00:52:56,870 --> 00:52:53,359
the air on the cautious side

1293
00:52:59,030 --> 00:52:56,880
not to build up expectations too high

1294
00:53:01,510 --> 00:52:59,040
uh and i think that that was a wise

1295
00:53:03,270 --> 00:53:01,520
course of action on his part in his role

1296
00:53:05,270 --> 00:53:03,280
as the director of the cbat the central

1297
00:53:07,349 --> 00:53:05,280
bureau for astronomical telegrams that

1298
00:53:08,790 --> 00:53:07,359
was the right course of action for him

1299
00:53:10,630 --> 00:53:08,800
uh and of course he was betting on

1300
00:53:13,430 --> 00:53:10,640
statistics and we beat the statistics

1301
00:53:15,190 --> 00:53:13,440
yeah we beat the odds

1302
00:53:16,630 --> 00:53:15,200
estimate of the minimum diameter

1303
00:53:18,549 --> 00:53:16,640
guesstimate of the minimum diameter of

1304
00:53:19,750 --> 00:53:18,559
fragment a yet

1305
00:53:22,790 --> 00:53:19,760
could you

1306
00:53:25,109 --> 00:53:22,800
of the single object or of the whole

1307
00:53:26,390 --> 00:53:25,119
original object fragment a the one that

1308
00:53:31,190 --> 00:53:26,400
that uh

1309
00:53:32,470 --> 00:53:31,200
would guess just from the relative

1310
00:53:34,790 --> 00:53:32,480
brightness

1311
00:53:37,430 --> 00:53:34,800
and the limits that were placed earlier

1312
00:53:39,589 --> 00:53:37,440
by the very careful work of hal weaver

1313
00:53:41,190 --> 00:53:39,599

uh that we're looking at an object that

1314
00:53:44,069 --> 00:53:41,200
is of the order of a kilometer in

1315
00:53:47,030 --> 00:53:44,079
diameter that's its real diameter

1316
00:53:48,950 --> 00:53:47,040
and the bigger objects are really bigger

1317
00:53:52,870 --> 00:53:48,960
and the original object was really about

1318
00:53:58,549 --> 00:53:56,150
by the way 10 kilometer object is um not

1319
00:54:00,790 --> 00:53:58,559
quite as large as about maybe what about

1320
00:54:02,470 --> 00:54:00,800
two-thirds the size of halvey's comet so

1321
00:54:04,150 --> 00:54:02,480
no that is the size of halley's the mean

1322
00:54:06,069 --> 00:54:04,160
diameter halley's comet is ten

1323
00:54:07,670 --> 00:54:06,079
kilometers all right so we're talking

1324
00:54:10,230 --> 00:54:07,680
about an object about the size of

1325
00:54:12,470 --> 00:54:10,240
howie's comet if uh this object were

1326
00:54:14,710 --> 00:54:12,480
near the earth it would be big and not

1327
00:54:17,670 --> 00:54:14,720
anymore but it would be big and bright

1328
00:54:18,710 --> 00:54:17,680
with a with a tail and everything um

1329
00:54:24,470 --> 00:54:18,720
this is a

1330
00:54:26,630 --> 00:54:24,480
you just explain a bit why the uh why

1331
00:54:28,630 --> 00:54:26,640
the radio wave uh

1332
00:54:30,710 --> 00:54:28,640
would have increased as a report from

1333
00:54:33,589 --> 00:54:30,720
japan yesterday why why would that

1334
00:54:37,670 --> 00:54:36,390
frankly i don't think anyone made that

1335
00:54:40,309 --> 00:54:37,680
prediction

1336
00:54:42,470 --> 00:54:40,319
we don't have a model

1337
00:54:44,790 --> 00:54:42,480
i i maybe some people are inventing them

1338
00:54:46,790 --> 00:54:44,800

right now i'll bet alex destler is

1339
00:54:47,990 --> 00:54:46,800
working on three or four models

1340
00:54:48,950 --> 00:54:48,000
but

1341
00:54:50,390 --> 00:54:48,960
you know

1342
00:54:52,870 --> 00:54:50,400
what we were going to see in the radio

1343
00:54:54,950 --> 00:54:52,880
wave region was a grab bag people are

1344
00:54:57,829 --> 00:54:54,960
going to be looking but really not

1345
00:55:00,309 --> 00:54:57,839
knowing how to predict it theoretically

1346
00:55:04,710 --> 00:55:00,319
time for just one or two more questions

1347
00:55:07,990 --> 00:55:06,309
glenda chu from the san jose mercury

1348
00:55:10,710 --> 00:55:08,000
news i wonder if the fact that these

1349
00:55:13,030 --> 00:55:10,720
impacts seem to be occurring maybe 13

1350
00:55:14,870 --> 00:55:13,040
minutes later than predicted is also

1351
00:55:16,470 --> 00:55:14,880
good news in the sense that they they

1352
00:55:17,829 --> 00:55:16,480
must be occurring closer to where you

1353
00:55:20,950 --> 00:55:17,839
all can see them

1354
00:55:22,150 --> 00:55:20,960
and uh did you know how if they are 13

1355
00:55:26,150 --> 00:55:22,160
minutes

1356
00:55:27,270 --> 00:55:26,160
um later than than thought how far away

1357
00:55:29,430 --> 00:55:27,280
from

1358
00:55:32,870 --> 00:55:29,440
rotating into our view are they then it

1359
00:55:35,510 --> 00:55:32,880
doesn't change the actual impact point

1360
00:55:36,549 --> 00:55:35,520
relative to our line of sight by very

1361
00:55:38,390 --> 00:55:36,559
much

1362
00:55:39,670 --> 00:55:38,400
uh it just it just means the comet's

1363
00:55:41,510 --> 00:55:39,680

coming a little bit later on its

1364
00:55:42,630 --> 00:55:41,520
trajectory but it won't shift it by very

1365
00:55:44,870 --> 00:55:42,640
much

1366
00:55:48,069 --> 00:55:44,880
yeah another thing about the sizes if

1367
00:55:49,750 --> 00:55:48,079
this um if it turns out that we're that

1368
00:55:52,390 --> 00:55:49,760
everyone's right and that this is close

1369
00:55:55,030 --> 00:55:52,400
to a 10 kilometer object i really want

1370
00:55:57,270 --> 00:55:55,040
to mention dennick sekinina paul chodas

1371
00:55:59,190 --> 00:55:57,280
and don yeomans at jpl

1372
00:55:59,990 --> 00:55:59,200
that have been saying all along that

1373
00:56:02,390 --> 00:56:00,000
their

1374
00:56:05,670 --> 00:56:02,400
models show a large a large

1375
00:56:07,510 --> 00:56:05,680
um a large comet before breakup not two

1376
00:56:10,309 --> 00:56:07,520
years ago so if this turns out to be

1377
00:56:12,069 --> 00:56:10,319
true this is a real mathematical victory

1378
00:56:13,589 --> 00:56:12,079
for them

1379
00:56:16,789 --> 00:56:13,599
question on the back miles o'brien with

1380
00:56:18,710 --> 00:56:16,799
cnn i know from over here i know from

1381
00:56:21,190 --> 00:56:18,720
speaking to you all this past week uh

1382
00:56:23,589 --> 00:56:21,200
that you had uh a fair amount of anxiety

1383
00:56:25,670 --> 00:56:23,599
about what might happen tonight give us

1384
00:56:27,750 --> 00:56:25,680
a sense of how much relief

1385
00:56:29,510 --> 00:56:27,760
uh this just recent announcement gives

1386
00:56:31,829 --> 00:56:29,520
you miles would you like to have some

1387
00:56:33,910 --> 00:56:31,839
fun campaign here with us

1388
00:56:35,829 --> 00:56:33,920

you probably can't tell that we're very

1389
00:56:37,670 --> 00:56:35,839
happy

1390
00:56:38,870 --> 00:56:37,680
it's a champagne

1391
00:56:41,510 --> 00:56:38,880
experience

1392
00:56:43,109 --> 00:56:41,520
we uh i i'm absolutely thrilled to

1393
00:56:46,789 --> 00:56:43,119
pieces

1394
00:56:48,069 --> 00:56:46,799
it's a it's it's it's such a rare night

1395
00:56:50,630 --> 00:56:48,079
when

1396
00:56:53,030 --> 00:56:50,640
nature calls you on the phone and says

1397
00:56:55,910 --> 00:56:53,040
i'm going to drop 20 comets into jupiter

1398
00:56:57,589 --> 00:56:55,920
at 138 miles an hour all i want you to

1399
00:56:59,030 --> 00:56:57,599
do is watch and i'm not going to tell

1400
00:57:01,270 --> 00:56:59,040
you what's going to happen in advance

1401
00:57:03,589 --> 00:57:01,280
just watch we are watching with

1402
00:57:06,630 --> 00:57:03,599
everything we've got tonight and nature

1403
00:57:08,309 --> 00:57:06,640
winked at us it's exciting

1404
00:57:10,470 --> 00:57:08,319
you can imagine that we've all worried

1405
00:57:11,829 --> 00:57:10,480
about the kahutek effect

1406
00:57:13,910 --> 00:57:11,839
and wondering whether we would all

1407
00:57:16,630 --> 00:57:13,920
whether we'd have to slink off and hide

1408
00:57:18,390 --> 00:57:16,640
under a flat rock somewhere

1409
00:57:22,230 --> 00:57:18,400
i think the answer is we're not going to

1410
00:57:25,349 --> 00:57:22,240
have to hide under a flat rock

1411
00:57:30,630 --> 00:57:25,359
see your your wildest expectations

1412
00:57:33,190 --> 00:57:31,829
we have uh

1413
00:57:35,109 --> 00:57:33,200

two more minutes to go we take a

1414
00:57:36,470 --> 00:57:35,119
question up here in front uh here we go

1415
00:57:38,390 --> 00:57:36,480
right

1416
00:57:40,309 --> 00:57:38,400
name affiliation please yeah paul reese

1417
00:57:42,470 --> 00:57:40,319
with ap uh if this is one of the

1418
00:57:43,990 --> 00:57:42,480
smallest what is the largest and when

1419
00:57:45,750 --> 00:57:44,000
you expect it to hit

1420
00:57:48,150 --> 00:57:45,760
good question

1421
00:57:50,549 --> 00:57:48,160
some of the largest fragments are g

1422
00:57:52,230 --> 00:57:50,559
h and k

1423
00:57:54,789 --> 00:57:52,240
and i think you have a press kit don

1424
00:57:56,870 --> 00:57:54,799
don't you that it has all of the times i

1425
00:57:58,630 --> 00:57:56,880
hate to give you i don't have a table in

1426
00:57:59,589 --> 00:57:58,640
front of me available they are available

1427
00:58:01,829 --> 00:57:59,599
uh

1428
00:58:04,710 --> 00:58:01,839
in the press case and the g h will be

1429
00:58:07,990 --> 00:58:04,720
coming down a couple of days

1430
00:58:12,390 --> 00:58:09,910
thank you thanks there's hal weaver the

1431
00:58:14,710 --> 00:58:12,400
one i'm personally excited about is q uh

1432
00:58:16,630 --> 00:58:14,720
that's the the uh president of the gang

1433
00:58:18,390 --> 00:58:16,640
of four the former gang of four one of

1434
00:58:19,430 --> 00:58:18,400
them kind of faded out

1435
00:58:21,109 --> 00:58:19,440
um

1436
00:58:23,910 --> 00:58:21,119
and another one split so we still have a

1437
00:58:25,990 --> 00:58:23,920
gang of four that happens on july 20th

1438
00:58:28,950 --> 00:58:26,000

which is the 25th anniversary of the

1439
00:58:30,390 --> 00:58:28,960
moon landing it's a very complex group

1440
00:58:32,630 --> 00:58:30,400
of fragments and they're all going to be

1441
00:58:34,870 --> 00:58:32,640
hitting within a very short time

1442
00:58:36,870 --> 00:58:34,880
i think we ought to recognize hal weaver

1443
00:58:39,109 --> 00:58:36,880
who's standing right back there and

1444
00:58:40,230 --> 00:58:39,119
spoke up hal is the one that made the

1445
00:58:43,190 --> 00:58:40,240
estimates

1446
00:58:45,670 --> 00:58:43,200
are from the hubble images a year ago in

1447
00:58:48,230 --> 00:58:45,680
july and came out with these estimates

1448
00:58:50,069 --> 00:58:48,240
of of the the largest nine being about

1449
00:58:52,390 --> 00:58:50,079
three kilometers maybe the very biggest

1450
00:58:53,829 --> 00:58:52,400
four and i think he ought to be feeling

1451
00:58:57,750 --> 00:58:53,839
pretty high tonight i hope he's got a

1452
00:59:00,390 --> 00:58:57,760
whole bottle of champagne with himself

1453
00:59:01,990 --> 00:59:00,400
i'm free we've run out of time uh right

1454
00:59:03,670 --> 00:59:02,000
now for question and answer and the

1455
00:59:05,190 --> 00:59:03,680
shoemakers have another engagement they

1456
00:59:07,190 --> 00:59:05,200
have to we're going to run down and

1457
00:59:09,670 --> 00:59:07,200
watch the impact of fragment b at the

1458
00:59:10,870 --> 00:59:09,680
naval observatory right now

1459
00:59:13,829 --> 00:59:10,880
we will have

1460
00:59:15,750 --> 00:59:13,839
our panel again tomorrow morning at 10

1461
00:59:18,230 --> 00:59:15,760
o'clock at the goddard space center and

1462
00:59:20,309 --> 00:59:18,240
also we'll have some updates later this

1463
00:59:21,670 --> 00:59:20,319

evening at 10 pm with heidi hamill and

1464
00:59:23,670 --> 00:59:21,680
the other science team members if you

1465
00:59:25,030 --> 00:59:23,680
would care to join us for that 10