NuSTAR News Update

#askNASA

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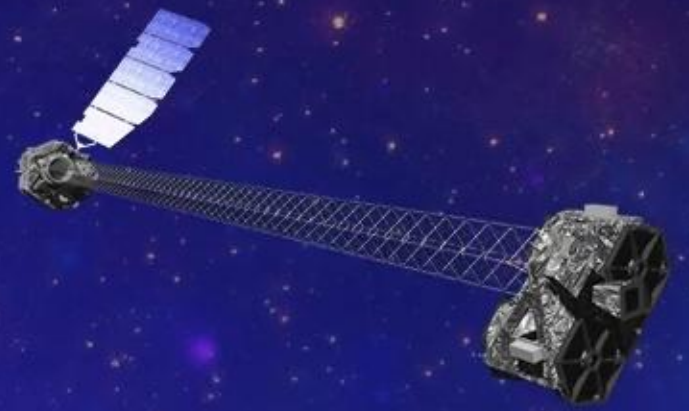

Jet Propulsion Laboratory
California Institute of Technology

1
00:00:03,990 --> 00:00:02,310
hello i'm j.d harrington public affairs

2
00:00:05,829 --> 00:00:04,000
officer at nasa headquarters in

3
00:00:08,150 --> 00:00:05,839
washington d.c

4
00:00:10,709 --> 00:00:08,160
i'd like to welcome you to today's media

5
00:00:13,030 --> 00:00:10,719
teleconference where we discuss the most

6
00:00:15,589 --> 00:00:13,040
recent science discoveries from nasa's

7
00:00:18,470 --> 00:00:15,599
nuclear spectroscopic telescope array

8
00:00:19,910 --> 00:00:18,480
commonly referred to as nustar

9
00:00:23,429 --> 00:00:19,920
neustar launched from an orbital

10
00:00:27,589 --> 00:00:23,439
sciences pegasus x rocket xl rocket on

11
00:00:29,910 --> 00:00:27,599
june 12 2012. after four short checkout

12
00:00:32,549 --> 00:00:29,920
period new star started observing high

13
00:00:35,030 --> 00:00:32,559

energy x-rays and higher resolution than

14
00:00:36,790 --> 00:00:35,040
any other space telescope before it

15
00:00:39,670 --> 00:00:36,800
now it enables astronomers to see the

16
00:00:41,350 --> 00:00:39,680
universe in an additional band of light

17
00:00:44,950 --> 00:00:41,360
advancing our understanding of how

18
00:00:47,350 --> 00:00:44,960
galaxies form and evolve before we begin

19
00:00:49,510 --> 00:00:47,360
a few topics to discuss we have four

20
00:00:51,270 --> 00:00:49,520
panelists joining us today and you can

21
00:00:55,830 --> 00:00:51,280
find the graphics the panelists will

22
00:00:58,069 --> 00:00:55,840
speak to by going to www.nasa.gov

23
00:00:59,590 --> 00:00:58,079
new star and clicking on the link in the

24
00:01:01,189 --> 00:00:59,600
top right corner

25
00:01:03,670 --> 00:01:01,199
now each panelist will give a short

26
00:01:05,750 --> 00:01:03,680
three to five minute briefing and once

27
00:01:07,830 --> 00:01:05,760
finished we'll then move to the question

28
00:01:09,030 --> 00:01:07,840
and answer session accepting questions

29
00:01:11,350 --> 00:01:09,040
from media that dialed into the

30
00:01:13,109 --> 00:01:11,360
telephone bridge here and those that

31
00:01:16,550 --> 00:01:13,119
submitted questions via twitter using

32
00:01:17,910 --> 00:01:16,560
the hashtag ask nasa now once again the

33
00:01:21,190 --> 00:01:17,920
graphics can be found by going to

34
00:01:26,710 --> 00:01:25,270
new star that's n-u-s-t-a-r

35
00:01:27,910 --> 00:01:26,720
and clicking on the link in the top

36
00:01:29,749 --> 00:01:27,920
right corner

37
00:01:32,710 --> 00:01:29,759
this media telecon will be limited to

38
00:01:37,670 --> 00:01:35,510

today's panelists include paul hertz

39
00:01:41,350 --> 00:01:37,680
nasa's astrophysics division director at

40
00:01:43,670 --> 00:01:41,360
nasa headquarters in washington d.c

41
00:01:45,830 --> 00:01:43,680
fiona harrison is also joining us she's

42
00:01:47,830 --> 00:01:45,840
the new star principal investigator at

43
00:01:49,749 --> 00:01:47,840
the california institute of technology

44
00:01:52,069 --> 00:01:49,759
in pasadena

45
00:01:55,429 --> 00:01:52,079
madio bachetti an astronomer at the

46
00:01:57,910 --> 00:01:55,439
university of tulese france

47
00:02:00,069 --> 00:01:57,920
and jeanette gladstone an astronomer at

48
00:02:02,389 --> 00:02:00,079
the university of alberta canada and

49
00:02:04,389 --> 00:02:02,399
with that we'll get started paul

50
00:02:06,870 --> 00:02:04,399
thank you jd

51
00:02:09,430 --> 00:02:06,880
today nasa is announcing observations

52
00:02:11,750 --> 00:02:09,440
that nustar has discovered the brightest

53
00:02:14,869 --> 00:02:11,760
pulsar ever seen

54
00:02:16,550 --> 00:02:14,879
an object in the nearby galaxy m82 is

55
00:02:19,750 --> 00:02:16,560
brighter than we thought was possible

56
00:02:22,470 --> 00:02:19,760
for a pulsar in fact it's so bright that

57
00:02:24,790 --> 00:02:22,480
we assumed it must be a black hole

58
00:02:27,910 --> 00:02:24,800
with nusar we have discovered that the

59
00:02:30,470 --> 00:02:27,920
object is emitting pulses of x-rays

60
00:02:32,470 --> 00:02:30,480
we know that black holes cannot pulse

61
00:02:34,390 --> 00:02:32,480
but pulsars can

62
00:02:36,869 --> 00:02:34,400
so the discovery of the brightest pulsar

63
00:02:38,790 --> 00:02:36,879

ever seen is creating a challenge for

64
00:02:40,790 --> 00:02:38,800
our theorists

65
00:02:43,030 --> 00:02:40,800
one of the things that nasa is very good

66
00:02:45,110 --> 00:02:43,040
at is space telescopes

67
00:02:47,430 --> 00:02:45,120
we have large space telescopes like

68
00:02:49,030 --> 00:02:47,440
hubble and chandra and we have small

69
00:02:51,589 --> 00:02:49,040
space telescopes

70
00:02:53,110 --> 00:02:51,599
nustar is one of nasa's small space

71
00:02:55,190 --> 00:02:53,120
telescopes

72
00:02:57,190 --> 00:02:55,200
it is a small explorer mission that was

73
00:02:59,350 --> 00:02:57,200
developed and is being operated by the

74
00:03:01,190 --> 00:02:59,360
principal investigator fiona harrison

75
00:03:03,350 --> 00:03:01,200
and her team

76
00:03:05,270 --> 00:03:03,360
nasa has multiple space telescopes in

77
00:03:06,790 --> 00:03:05,280
order to provide different views of the

78
00:03:08,710 --> 00:03:06,800
universe

79
00:03:10,470 --> 00:03:08,720
if you look at the first graphic labeled

80
00:03:12,470 --> 00:03:10,480
hertz1

81
00:03:14,470 --> 00:03:12,480
we see two different views of the nearby

82
00:03:16,869 --> 00:03:14,480
galaxy m82

83
00:03:19,910 --> 00:03:16,879
on the left is an image taken with the

84
00:03:22,790 --> 00:03:19,920
hubble space telescope in visible light

85
00:03:24,710 --> 00:03:22,800
this is what our eyes see

86
00:03:27,110 --> 00:03:24,720
on the right is an image of the same

87
00:03:30,309 --> 00:03:27,120
galaxy taken in low energy x-rays with

88
00:03:31,990 --> 00:03:30,319

the chandra x-ray observatory

89
00:03:34,309 --> 00:03:32,000
it's clear that we're looking at very

90
00:03:35,670 --> 00:03:34,319
different phenomena in this galaxy when

91
00:03:37,430 --> 00:03:35,680
we're looking at it using different

92
00:03:39,990 --> 00:03:37,440
kinds of light

93
00:03:42,070 --> 00:03:40,000
nasa will continue to develop different

94
00:03:43,990 --> 00:03:42,080
kinds of space telescopes with a broad

95
00:03:45,750 --> 00:03:44,000
range of capabilities so that

96
00:03:47,110 --> 00:03:45,760
astronomers can continue to study the

97
00:03:48,550 --> 00:03:47,120
most compelling questions of the

98
00:03:50,390 --> 00:03:48,560
universe

99
00:03:53,270 --> 00:03:50,400
today's discovery could have been made

100
00:03:55,910 --> 00:03:53,280
only with nustar the only telescope that

101
00:03:58,710 --> 00:03:55,920
can make these these uh highly focused

102
00:04:00,630 --> 00:03:58,720
images using high energy x-rays

103
00:04:03,110 --> 00:04:00,640
to give you the details here is fiona

104
00:04:04,869 --> 00:04:03,120
harrison a professor at caltech and the

105
00:04:08,390 --> 00:04:04,879
principal investigator of the nustar

106
00:04:10,229 --> 00:04:08,400
mission fiona okay thanks paul so

107
00:04:13,110 --> 00:04:10,239
as paul told you today we're announcing

108
00:04:15,509 --> 00:04:13,120
the discovery of a pulsating dead star

109
00:04:17,909 --> 00:04:15,519
that's beaming x-rays with the energy of

110
00:04:20,629 --> 00:04:17,919
about 10 million suns

111
00:04:21,830 --> 00:04:20,639
this dead star called a neutron star

112
00:04:24,469 --> 00:04:21,840
packs about the

113
00:04:27,189 --> 00:04:24,479

mass of the whole sun into a region the

114
00:04:29,670 --> 00:04:27,199
size of san francisco yet this little

115
00:04:31,990 --> 00:04:29,680
mighty mouse pulsar packs the power of a

116
00:04:34,870 --> 00:04:32,000
much bigger black hole

117
00:04:37,110 --> 00:04:34,880
this discovery is astonishing because no

118
00:04:39,110 --> 00:04:37,120
object like this has ever been observed

119
00:04:40,550 --> 00:04:39,120
to be even remotely this bright

120
00:04:41,749 --> 00:04:40,560
theorists didn't think that it was

121
00:04:43,510 --> 00:04:41,759
possible

122
00:04:45,590 --> 00:04:43,520
the ultimate source of this object's

123
00:04:48,390 --> 00:04:45,600
power comes from the high rate at which

124
00:04:50,230 --> 00:04:48,400
it is feeding or accreting off matter

125
00:04:52,070 --> 00:04:50,240
from a companion star

126
00:04:54,070 --> 00:04:52,080
high feeding or accretion rates are

127
00:04:55,990 --> 00:04:54,080
important for growing black holes in the

128
00:04:58,150 --> 00:04:56,000
early universe this affects the

129
00:05:00,550 --> 00:04:58,160
formation of galaxies and structures in

130
00:05:02,870 --> 00:05:00,560
the universe and studying objects like

131
00:05:04,390 --> 00:05:02,880
this helps astronomers understand this

132
00:05:05,990 --> 00:05:04,400
important process

133
00:05:08,950 --> 00:05:06,000
so if you scroll down

134
00:05:11,189 --> 00:05:08,960
to harrison one on the webpage

135
00:05:13,990 --> 00:05:11,199
this image shows you a visible light

136
00:05:17,830 --> 00:05:14,000
picture of the galaxy called the cigar

137
00:05:20,469 --> 00:05:17,840
galaxy or otherwise known as m82 this is

138
00:05:22,469 --> 00:05:20,479

the galaxy in which this object was

139
00:05:24,550 --> 00:05:22,479
discovered by nustar

140
00:05:26,870 --> 00:05:24,560
the purple dot shows you the location

141
00:05:28,950 --> 00:05:26,880
from which nustar observed intensely

142
00:05:30,390 --> 00:05:28,960
bright x-rays during a two-week long

143
00:05:32,070 --> 00:05:30,400
observation

144
00:05:34,950 --> 00:05:32,080
due to their brilliance

145
00:05:37,270 --> 00:05:34,960
x-ray objects like this one found in

146
00:05:41,590 --> 00:05:37,280
nearby galaxies not in the precise

147
00:05:43,830 --> 00:05:41,600
center but offset from the nucleus

148
00:05:46,390 --> 00:05:43,840
the precise point about which all stars

149
00:05:49,430 --> 00:05:46,400
and dust and gas revolve these are

150
00:05:51,670 --> 00:05:49,440
called ultraluminous x-ray sources

151
00:05:53,909 --> 00:05:51,680
until now astronomers have believed that

152
00:05:56,550 --> 00:05:53,919
they're all powered by rapidly feeding

153
00:05:59,590 --> 00:05:56,560
black holes the reason for this is that

154
00:06:02,550 --> 00:05:59,600
black holes due to their mass can power

155
00:06:04,629 --> 00:06:02,560
very bright x-ray light bulbs

156
00:06:07,350 --> 00:06:04,639
so why did we think these ultraluminous

157
00:06:09,350 --> 00:06:07,360
x-ray sources are powered by black holes

158
00:06:12,230 --> 00:06:09,360
well the energy source that powers

159
00:06:15,749 --> 00:06:12,240
bright x-ray sources is gravity matter

160
00:06:18,550 --> 00:06:15,759
falls onto a very dense very compact

161
00:06:20,790 --> 00:06:18,560
object the more mass of the object and

162
00:06:22,950 --> 00:06:20,800
the more matter that falls on the more

163
00:06:25,350 --> 00:06:22,960

power that it can produce

164
00:06:26,950 --> 00:06:25,360
so if you scroll down to the graphic

165
00:06:29,510 --> 00:06:26,960
harrison 2

166
00:06:32,230 --> 00:06:29,520
this shows you the mass range of dense

167
00:06:35,189 --> 00:06:32,240
objects that can power these x-ray light

168
00:06:37,430 --> 00:06:35,199
bulbs on the small side stellar mass

169
00:06:40,629 --> 00:06:37,440
black holes neutron stars and white

170
00:06:43,189 --> 00:06:40,639
dwarfs these all form as remnants of the

171
00:06:45,670 --> 00:06:43,199
death of a single massive star

172
00:06:48,230 --> 00:06:45,680
we know that all these types of objects

173
00:06:50,469 --> 00:06:48,240
exist in our galaxy not in the precise

174
00:06:52,550 --> 00:06:50,479
middle as i said but scattered around in

175
00:06:53,749 --> 00:06:52,560
the regions where massive stars live and

176
00:06:56,230 --> 00:06:53,759
die

177
00:06:58,870 --> 00:06:56,240
on the big side the very right hand side

178
00:07:01,110 --> 00:06:58,880
of the graph are supermassive black

179
00:07:04,550 --> 00:07:01,120
holes now these are different they

180
00:07:06,230 --> 00:07:04,560
reside in the very hearts of galaxies

181
00:07:08,469 --> 00:07:06,240
and they're they are

182
00:07:10,790 --> 00:07:08,479
formed not instantaneously from the

183
00:07:13,510 --> 00:07:10,800
explosion of a single star but by

184
00:07:15,110 --> 00:07:13,520
gorging on material for very long times

185
00:07:17,830 --> 00:07:15,120
a good fraction of the age of the

186
00:07:20,550 --> 00:07:17,840
universe in the middle

187
00:07:23,670 --> 00:07:20,560
uh underneath that question mark are

188
00:07:26,550 --> 00:07:23,680

what we call intermediate black mass

189
00:07:28,550 --> 00:07:26,560
black holes now do they exist

190
00:07:30,230 --> 00:07:28,560
well we don't know but these

191
00:07:32,710 --> 00:07:30,240
ultraluminous x-ray sources are

192
00:07:34,309 --> 00:07:32,720
considered good candidates that may fill

193
00:07:35,189 --> 00:07:34,319
this mass void

194
00:07:36,950 --> 00:07:35,199
why

195
00:07:39,110 --> 00:07:36,960
well as i said the more massive an

196
00:07:40,070 --> 00:07:39,120
object and the more it eats the brighter

197
00:07:42,309 --> 00:07:40,080
it is

198
00:07:44,550 --> 00:07:42,319
there's a limit to any object's food

199
00:07:47,830 --> 00:07:44,560
supply of course so the very brightest

200
00:07:49,270 --> 00:07:47,840
x-ray sources are suspected

201
00:07:50,870 --> 00:07:49,280
to harbor

202
00:07:53,029 --> 00:07:50,880
black holes

203
00:07:55,270 --> 00:07:53,039
think of it this way with a given food

204
00:07:57,670 --> 00:07:55,280
supply the brightness depends directly

205
00:08:00,869 --> 00:07:57,680
on the mass so if a one solar mass

206
00:08:03,430 --> 00:08:00,879
neutron star produces 50 watts a hundred

207
00:08:04,869 --> 00:08:03,440
solar mass black hole will produce 5 000

208
00:08:07,430 --> 00:08:04,879
watts that's the difference between a

209
00:08:09,830 --> 00:08:07,440
night light and a spotlight

210
00:08:12,790 --> 00:08:09,840
so nustar found this bright spotlight in

211
00:08:15,670 --> 00:08:12,800
the galaxy m82 and immediately we

212
00:08:17,430 --> 00:08:15,680
thought this is so bright it's a large

213
00:08:19,430 --> 00:08:17,440

black hole now if you look at the

214
00:08:21,909 --> 00:08:19,440
graphic harrison 3

215
00:08:24,629 --> 00:08:21,919
this is an artist

216
00:08:27,510 --> 00:08:24,639
depiction of what we were quite sure the

217
00:08:28,550 --> 00:08:27,520
object looked like a black hole shown on

218
00:08:30,150 --> 00:08:28,560
the left

219
00:08:32,310 --> 00:08:30,160
feeding off

220
00:08:33,350 --> 00:08:32,320
matter from a normal star which is shown

221
00:08:35,909 --> 00:08:33,360
on the right

222
00:08:37,909 --> 00:08:35,919
and even with a black hole 50 to 100

223
00:08:40,790 --> 00:08:37,919
times the mass of the sun the feeding

224
00:08:43,670 --> 00:08:40,800
rate implied is is pretty extreme

225
00:08:46,550 --> 00:08:43,680
but then we discovered that rather than

226
00:08:49,750 --> 00:08:46,560
being just being extreme the object is

227
00:08:53,030 --> 00:08:49,760
in fact astonishing it turns

228
00:08:53,750 --> 00:08:53,040
i'll turn it over to mateo bakety to

229
00:08:58,230 --> 00:08:53,760
tell

230
00:08:59,910 --> 00:08:58,240
was destroyed mateo

231
00:09:03,110 --> 00:08:59,920
hi thanks fiona

232
00:09:05,430 --> 00:09:03,120
um so how did this happen uh i was

233
00:09:07,990 --> 00:09:05,440
looking at this source and i was of

234
00:09:09,829 --> 00:09:08,000
course sure that it was a black hole

235
00:09:11,030 --> 00:09:09,839
like everybody else

236
00:09:13,509 --> 00:09:11,040
and

237
00:09:16,550 --> 00:09:13,519
i was particularly interested in how the

238
00:09:19,030 --> 00:09:16,560

signal the x-ray signal changed in time

239
00:09:20,550 --> 00:09:19,040
because seeing how this signal changes

240
00:09:22,949 --> 00:09:20,560
in time sometimes you have the

241
00:09:24,310 --> 00:09:22,959
possibility to measure the mass of the

242
00:09:26,870 --> 00:09:24,320
black hole

243
00:09:30,630 --> 00:09:26,880
but then i realized that the signal was

244
00:09:31,670 --> 00:09:30,640
not only changing but it was pulsing

245
00:09:34,070 --> 00:09:31,680
and

246
00:09:36,870 --> 00:09:34,080
that's another story you can see it on

247
00:09:40,070 --> 00:09:36,880
figure bucket one

248
00:09:42,310 --> 00:09:40,080
these are the new start data when the

249
00:09:45,030 --> 00:09:42,320
pulse is on and when the pulse is off

250
00:09:47,430 --> 00:09:45,040
you can see a clear difference

251
00:09:50,550 --> 00:09:47,440
um

252
00:09:52,630 --> 00:09:50,560
already in the in this picture if you

253
00:09:55,990 --> 00:09:52,640
had x-ray eyes that's probably what you

254
00:09:58,310 --> 00:09:56,000
would see um well as i was saying black

255
00:10:00,790 --> 00:09:58,320
holes cannot pulse

256
00:10:02,949 --> 00:10:00,800
the only way to produce a pulse like

257
00:10:05,590 --> 00:10:02,959
that so stable

258
00:10:08,150 --> 00:10:05,600
and and also so fast is to have a

259
00:10:10,389 --> 00:10:08,160
rotating neutron star

260
00:10:13,509 --> 00:10:10,399
you can see how this works in the video

261
00:10:19,190 --> 00:10:16,870
there is matter that that is

262
00:10:21,430 --> 00:10:19,200
captured in the gravitational field of

263
00:10:23,590 --> 00:10:21,440

the neutron star and tries to fall on

264
00:10:26,389 --> 00:10:23,600
the star but then

265
00:10:27,509 --> 00:10:26,399
these stars have tremendous magnetic

266
00:10:32,630 --> 00:10:27,519
field

267
00:10:34,949 --> 00:10:32,640
is able to capture the matter before it

268
00:10:37,590 --> 00:10:34,959
falls on the surface of the star and

269
00:10:41,590 --> 00:10:37,600
concentrate the fall of the matter onto

270
00:10:43,590 --> 00:10:41,600
to very bright spots these two hot spots

271
00:10:46,389 --> 00:10:43,600
are

272
00:10:48,310 --> 00:10:46,399
can reach like 10 million degrees or

273
00:10:52,949 --> 00:10:48,320
more so you can

274
00:10:53,829 --> 00:10:52,959
think of them like huge x-ray lamps

275
00:10:56,550 --> 00:10:53,839
these

276
00:10:59,590 --> 00:10:56,560
lengths of x-rays as the star rotates

277
00:11:02,389 --> 00:10:59,600
are only visible by us when they're

278
00:11:05,910 --> 00:11:02,399
pointing at us think about it as a big

279
00:11:08,230 --> 00:11:05,920
x-ray lighthouse and in a lighthouse

280
00:11:11,269 --> 00:11:08,240
what you see is a pulsed signal and

281
00:11:15,350 --> 00:11:11,279
that's exactly why in these systems we

282
00:11:16,230 --> 00:11:15,360
observe an x-ray pulse that's why also

283
00:11:20,230 --> 00:11:16,240
these

284
00:11:25,750 --> 00:11:22,790
well there are many known pulsers in our

285
00:11:27,190 --> 00:11:25,760
galaxy also that work with this

286
00:11:30,389 --> 00:11:27,200
mechanism

287
00:11:33,509 --> 00:11:30,399
the only problem is that they're

288
00:11:35,750 --> 00:11:33,519

never so bright not even closed

289
00:11:38,470 --> 00:11:35,760
so why this one can manage to be so

290
00:11:41,350 --> 00:11:38,480
bright it's still under investigation

291
00:11:44,069 --> 00:11:41,360
because well until now

292
00:11:45,030 --> 00:11:44,079
nobody thought it was even possible

293
00:11:51,190 --> 00:11:45,040
um

294
00:11:55,430 --> 00:11:51,200
glaston from university of albera to to

295
00:11:59,190 --> 00:11:55,440
to give a wider look

296
00:12:02,230 --> 00:12:00,550
thanks mateo

297
00:12:04,310 --> 00:12:02,240
um thanks for the introduction and also

298
00:12:06,069 --> 00:12:04,320
thanks for the team for inviting me i

299
00:12:07,829 --> 00:12:06,079
wasn't actually part of this project but

300
00:12:09,670 --> 00:12:07,839
i do work on these ultra luminous sex

301
00:12:11,670 --> 00:12:09,680
resources and i have worked on neutron

302
00:12:13,509 --> 00:12:11,680
stars in the past and so i found this

303
00:12:15,910 --> 00:12:13,519
really interesting result and it's great

304
00:12:17,990 --> 00:12:15,920
to see a small telescope making such big

305
00:12:19,990 --> 00:12:18,000
discoveries result that's going to lead

306
00:12:21,509 --> 00:12:20,000
to much discussions in many areas of

307
00:12:23,269 --> 00:12:21,519
astronomy

308
00:12:25,190 --> 00:12:23,279
ultraluminous sex resources have been a

309
00:12:26,870 --> 00:12:25,200
mystery since they were first observed

310
00:12:29,590 --> 00:12:26,880
really but the first thing that we all

311
00:12:31,110 --> 00:12:29,600
agreed on as fiona said earlier was that

312
00:12:33,190 --> 00:12:31,120
we thought these things must be black

313
00:12:35,829 --> 00:12:33,200

holes due to the brightness of them the

314
00:12:37,430 --> 00:12:35,839
only question that we had left was

315
00:12:39,750 --> 00:12:37,440
what kind of mass were they how much did

316
00:12:41,750 --> 00:12:39,760
they weigh were they stellar remnant

317
00:12:44,310 --> 00:12:41,760
black holes were they things that were

318
00:12:45,990 --> 00:12:44,320
extreme systems so the size of black

319
00:12:49,910 --> 00:12:46,000
holes that we find in our own galaxies

320
00:12:52,230 --> 00:12:49,920
but eating at much more extreme rates

321
00:12:54,310 --> 00:12:52,240
or were there these mysterious and

322
00:12:56,629 --> 00:12:54,320
elusive intermediate mass black holes

323
00:12:58,389 --> 00:12:56,639
the missing link between the dela

324
00:13:01,509 --> 00:12:58,399
remnants and the supermassive black

325
00:13:03,430 --> 00:13:01,519
holes found in the centre of galaxy

326
00:13:05,750 --> 00:13:03,440
well recently the community's been

327
00:13:07,670 --> 00:13:05,760
settling on the idea that

328
00:13:09,670 --> 00:13:07,680
the majority of these are stellar

329
00:13:11,910 --> 00:13:09,680
remnant black holes in a new extreme

330
00:13:13,829 --> 00:13:11,920
accretion rate which is a very exciting

331
00:13:15,110 --> 00:13:13,839
discovery and it kind of pushes the

332
00:13:16,949 --> 00:13:15,120
boundaries on what we thought was

333
00:13:18,470 --> 00:13:16,959
possible for accretion for how these

334
00:13:20,550 --> 00:13:18,480
objects feed

335
00:13:23,990 --> 00:13:20,560
and this was supported by a paper that

336
00:13:25,350 --> 00:13:24,000
came out last year um by a group led by

337
00:13:27,670 --> 00:13:25,360
louis

338
00:13:29,829 --> 00:13:27,680

um and also by a paper that comes out in

339
00:13:31,509 --> 00:13:29,839
the same issue of nature by a group led

340
00:13:34,790 --> 00:13:31,519
by march

341
00:13:36,710 --> 00:13:34,800
um but the galaxy m82

342
00:13:39,030 --> 00:13:36,720
is actually making us stop and think

343
00:13:41,750 --> 00:13:39,040
about these things so if you go to

344
00:13:45,990 --> 00:13:41,760
figure gladstone one you'll see a zoom

345
00:13:47,750 --> 00:13:46,000
in of the area in m82 that holds this

346
00:13:49,590 --> 00:13:47,760
qlx that we're talking about today this

347
00:13:51,269 --> 00:13:49,600
ultra luminous x-ray source and you'll

348
00:13:52,150 --> 00:13:51,279
see that there's two sources labeled

349
00:13:54,949 --> 00:13:52,160
there

350
00:13:56,470 --> 00:13:54,959
x1 which is the brightest x-ray source

351
00:13:59,430 --> 00:13:56,480
in this galaxy

352
00:14:02,870 --> 00:13:59,440
and x2 which is the second brightest

353
00:14:06,310 --> 00:14:02,880
so x1 was in the news recently because

354
00:14:08,230 --> 00:14:06,320
recent x-ray analysis of that source has

355
00:14:10,470 --> 00:14:08,240
shown that it may be one of these

356
00:14:13,269 --> 00:14:10,480
intermediate mass black holes

357
00:14:15,509 --> 00:14:13,279
the authors suggested that this object

358
00:14:16,629 --> 00:14:15,519
weigh about 400 times the mass of our

359
00:14:18,550 --> 00:14:16,639
sun

360
00:14:21,670 --> 00:14:18,560
so it's definitely in that intermediate

361
00:14:27,350 --> 00:14:25,590
now we're looking at m82 x2 here today

362
00:14:29,350 --> 00:14:27,360
and this object isn't even a black hole

363
00:14:31,829 --> 00:14:29,360

at all so this source is even more

364
00:14:34,310 --> 00:14:31,839
extreme than anything we'd previously

365
00:14:35,829 --> 00:14:34,320
considered this is a neutron star not

366
00:14:37,990 --> 00:14:35,839
only feeding at black hole rates but

367
00:14:40,310 --> 00:14:38,000
feeding at rates that are extreme for

368
00:14:42,870 --> 00:14:40,320
these stellar remnant black holes

369
00:14:44,790 --> 00:14:42,880
so this is quite exciting

370
00:14:46,710 --> 00:14:44,800
it's definitely going to be a surprise

371
00:14:49,189 --> 00:14:46,720
to the community that studies these

372
00:14:50,790 --> 00:14:49,199
ultra roma sex resources but not just

373
00:14:53,350 --> 00:14:50,800
that community it's going to have wider

374
00:14:54,949 --> 00:14:53,360
impact as well the sources in m82 are

375
00:14:57,110 --> 00:14:54,959
really kind of challenging theories and

376
00:14:59,509 --> 00:14:57,120
pushing our limits and understandings

377
00:15:02,389 --> 00:14:59,519
of ultra human sexual sources but also

378
00:15:04,710 --> 00:15:02,399
neutron star physics and it's also going

379
00:15:06,629 --> 00:15:04,720
to give theorists a challenge in trying

380
00:15:08,710 --> 00:15:06,639
to explain the

381
00:15:10,550 --> 00:15:08,720
new ideas on how

382
00:15:12,550 --> 00:15:10,560
neutron stars and black holes can feed

383
00:15:14,710 --> 00:15:12,560
at these rates an area that we call

384
00:15:17,030 --> 00:15:14,720
accretion physics

385
00:15:18,949 --> 00:15:17,040
this can help us explain the rapid

386
00:15:20,870 --> 00:15:18,959
growth of massive black holes in the

387
00:15:22,949 --> 00:15:20,880
early universe

388
00:15:25,350 --> 00:15:22,959

it can help us understand more about the

389
00:15:27,829 --> 00:15:25,360
formation of supermassive black holes

390
00:15:29,750 --> 00:15:27,839
and there are actually links between the

391
00:15:31,910 --> 00:15:29,760
ma between the super massive black holes

392
00:15:33,750 --> 00:15:31,920
found in the centers of galaxies and the

393
00:15:35,110 --> 00:15:33,760
galaxies they would reside in and so

394
00:15:36,790 --> 00:15:35,120
it's thought that if you can find out

395
00:15:38,230 --> 00:15:36,800
more about the formation of one you can

396
00:15:40,389 --> 00:15:38,240
find out about the formation of the

397
00:15:42,470 --> 00:15:40,399
other so this could tell us more about

398
00:15:44,230 --> 00:15:42,480
the formation of galaxies as well so

399
00:15:46,310 --> 00:15:44,240
this is really an exciting result

400
00:15:48,389 --> 00:15:46,320
showing new possibilities not only for

401
00:15:50,710 --> 00:15:48,399
areas of research in ultraluminous x-ray

402
00:15:52,949 --> 00:15:50,720
sources but also also for other fields

403
00:15:55,189 --> 00:15:52,959
in astronomy so i'd like to thank the

404
00:15:58,629 --> 00:15:55,199
team again for inviting me along today

405
00:15:59,829 --> 00:15:58,639
and i'd like to pass it back to jd

406
00:16:01,350 --> 00:15:59,839
thanks jeanette

407
00:16:03,030 --> 00:16:01,360
and with that we'll start the question

408
00:16:04,949 --> 00:16:03,040
and answer session we have several

409
00:16:06,629 --> 00:16:04,959
reporters on the telephone bridge today

410
00:16:08,870 --> 00:16:06,639
and as such we'll need to limit everyone

411
00:16:10,949 --> 00:16:08,880
to one question with one follow-up i'm

412
00:16:13,509 --> 00:16:10,959
sure we'll be able to get around and for

413
00:16:15,189 --> 00:16:13,519

uh additional questions we'll start from

414
00:16:17,189 --> 00:16:15,199
the beginning uh

415
00:16:18,790 --> 00:16:17,199
and you me our operator

416
00:16:20,389 --> 00:16:18,800
should identify you

417
00:16:22,389 --> 00:16:20,399
if not though i ask that you identify

418
00:16:23,910 --> 00:16:22,399
yourself your media affiliation and then

419
00:16:26,389 --> 00:16:23,920
direct your question to a specific

420
00:16:28,710 --> 00:16:26,399
panelist if possible to eliminate any

421
00:16:30,550 --> 00:16:28,720
confusion now for those dialing in you

422
00:16:32,790 --> 00:16:30,560
can push the star one keys on your

423
00:16:34,949 --> 00:16:32,800
telephone to be placed in the queue

424
00:16:36,470 --> 00:16:34,959
and to use twitter send your questions

425
00:16:41,189 --> 00:16:36,480
to

426
00:16:43,030 --> 00:16:41,199
ask nasa and with that we'll begin humi

427
00:16:45,110 --> 00:16:43,040
thank you as a reminder if you'd like to

428
00:16:50,230 --> 00:16:45,120
ask a question please press star one and

429
00:16:55,670 --> 00:16:52,310
first question comes from bill hardwood

430
00:16:57,829 --> 00:16:55,680
from cbs news your line is now open

431
00:16:59,509 --> 00:16:57,839
thank you very much and i apologize if

432
00:17:00,790 --> 00:16:59,519
i'd i missed something i want to make

433
00:17:02,550 --> 00:17:00,800
sure i understand the relationship

434
00:17:04,390 --> 00:17:02,560
between ultraluminous x-ray sources and

435
00:17:06,150 --> 00:17:04,400
intermediate black holes because

436
00:17:07,110 --> 00:17:06,160
i'm not sure i'm getting that what is

437
00:17:17,189 --> 00:17:07,120
the

438
00:17:20,630 --> 00:17:19,029

okay uh jeanette do you want to take

439
00:17:23,189 --> 00:17:20,640
that or shall i

440
00:17:25,829 --> 00:17:23,199
um i'm happy to take it yeah

441
00:17:27,909 --> 00:17:25,839
uh thanks for the question so these

442
00:17:30,870 --> 00:17:27,919
intermediate mass black holes were

443
00:17:32,630 --> 00:17:30,880
suggested as a way to kind of have a

444
00:17:34,230 --> 00:17:32,640
stepping stone between the stellar

445
00:17:36,070 --> 00:17:34,240
remnant black holes that we see in our

446
00:17:38,230 --> 00:17:36,080
galaxy and the supermassive black holes

447
00:17:39,669 --> 00:17:38,240
in the center of galaxies it gives you a

448
00:17:41,590 --> 00:17:39,679
way to kind of bridge the gap between

449
00:17:43,430 --> 00:17:41,600
them but it also gives you a way to form

450
00:17:45,510 --> 00:17:43,440
the supermassive black holes found in

451
00:17:48,230 --> 00:17:45,520
the center of galaxies

452
00:17:50,789 --> 00:17:48,240
now as fiona said you've got this

453
00:17:52,549 --> 00:17:50,799
we we know from observing sources that

454
00:17:55,430 --> 00:17:52,559
we've seen in this galaxy and in other

455
00:17:57,909 --> 00:17:55,440
galaxies the brightness of these sources

456
00:17:59,110 --> 00:17:57,919
scales with their mass scales with their

457
00:18:00,630 --> 00:17:59,120
weight

458
00:18:02,630 --> 00:18:00,640
so if you

459
00:18:04,230 --> 00:18:02,640
increase in luminosity if you look at

460
00:18:06,390 --> 00:18:04,240
x-ray sources in the sky and look at

461
00:18:08,390 --> 00:18:06,400
them as they increase you go through

462
00:18:10,470 --> 00:18:08,400
neutron stars through stellar mass black

463
00:18:12,070 --> 00:18:10,480

holes and then we seem to have a gap

464
00:18:13,510 --> 00:18:12,080
and then you get to supermassive black

465
00:18:15,270 --> 00:18:13,520
holes they're the brightest things that

466
00:18:16,950 --> 00:18:15,280
you see

467
00:18:18,789 --> 00:18:16,960
and so it was thought that if you get

468
00:18:20,789 --> 00:18:18,799
something that is in intermediate in

469
00:18:22,789 --> 00:18:20,799
luminosity intermediate and brightness

470
00:18:24,950 --> 00:18:22,799
then it could also be intermediate in

471
00:18:27,590 --> 00:18:24,960
mass so it might be these objects that

472
00:18:29,430 --> 00:18:27,600
could help us explain how to make

473
00:18:31,510 --> 00:18:29,440
supermassive black holes does that make

474
00:18:34,310 --> 00:18:31,520
sense

475
00:18:36,630 --> 00:18:34,320
yeah so let me clarify a little more so

476
00:18:37,830 --> 00:18:36,640
what what is astonishing about this

477
00:18:42,549 --> 00:18:37,840
result

478
00:18:44,549 --> 00:18:42,559
we look at these bright x-ray light

479
00:18:47,110 --> 00:18:44,559
bulbs in

480
00:18:51,190 --> 00:18:47,120
nearby galaxies we call them all ultra

481
00:18:53,270 --> 00:18:51,200
luminous x-ray sources because they're

482
00:18:54,950 --> 00:18:53,280
sort of intermediate in brightness

483
00:18:56,950 --> 00:18:54,960
between

484
00:18:59,830 --> 00:18:56,960
what we would normally think of as a

485
00:19:01,029 --> 00:18:59,840
neutron star and and uh supermassive

486
00:19:02,710 --> 00:19:01,039
black hole

487
00:19:04,470 --> 00:19:02,720
so that this is what led people to

488
00:19:06,390 --> 00:19:04,480

believe they were all the same thing

489
00:19:08,549 --> 00:19:06,400
maybe intermediate mass black holes and

490
00:19:11,430 --> 00:19:08,559
this has been turned on its head

491
00:19:12,630 --> 00:19:11,440
by the discovery that want today that

492
00:19:15,270 --> 00:19:12,640
one of them

493
00:19:17,830 --> 00:19:15,280
is in fact a pulsar which contains a

494
00:19:18,549 --> 00:19:17,840
neutron star not a black hole at all

495
00:19:21,830 --> 00:19:18,559
so

496
00:19:23,029 --> 00:19:21,840
this is kind of overturning our ideas

497
00:19:26,549 --> 00:19:23,039
and

498
00:19:28,630 --> 00:19:26,559
making us wonder how something that's

499
00:19:31,510 --> 00:19:28,640
you know this little

500
00:19:33,110 --> 00:19:31,520
uh pulsar can be so mighty

501
00:19:34,150 --> 00:19:33,120
uh so bright

502
00:19:36,630 --> 00:19:34,160
and

503
00:19:38,549 --> 00:19:36,640
uh that's a a challenge

504
00:19:40,390 --> 00:19:38,559
well well i'm sorry but that that is

505
00:19:42,070 --> 00:19:40,400
exactly my question i understand this is

506
00:19:44,310 --> 00:19:42,080
a new class of particle but could i mean

507
00:19:46,150 --> 00:19:44,320
i mean star or object i should say but i

508
00:19:48,310 --> 00:19:46,160
mean is that something that serves as a

509
00:19:49,750 --> 00:19:48,320
candidate for this intermediate mass

510
00:19:50,630 --> 00:19:49,760
object or is this something completely

511
00:19:52,870 --> 00:19:50,640
different that's what i'm not

512
00:19:55,190 --> 00:19:52,880
understanding okay yeah so the one that

513
00:19:59,110 --> 00:19:55,200

we are talking about today the one

514
00:20:00,390 --> 00:19:59,120
labeled x2 on gladstone one isn't a

515
00:20:07,270 --> 00:20:00,400
black hole

516
00:20:09,830 --> 00:20:07,280
neutron star which is the dead remnant

517
00:20:11,669 --> 00:20:09,840
that's left over when a massive star

518
00:20:14,630 --> 00:20:11,679
explodes

519
00:20:18,230 --> 00:20:14,640
now what may be confusing you is the one

520
00:20:20,710 --> 00:20:18,240
labeled x1 which is in the same galaxy

521
00:20:22,950 --> 00:20:20,720
is a candidate to be an intermediate

522
00:20:23,990 --> 00:20:22,960
mass black hole so right next to one

523
00:20:26,870 --> 00:20:24,000
another

524
00:20:27,830 --> 00:20:26,880
almost the same brightness uh in this

525
00:20:30,149 --> 00:20:27,840
image

526
00:20:32,549 --> 00:20:30,159
we have an intermediate mass black hole

527
00:20:33,510 --> 00:20:32,559
and this little mighty mouse pulsar

528
00:20:36,470 --> 00:20:33,520
that's

529
00:20:39,270 --> 00:20:36,480
uh really amazing

530
00:20:41,590 --> 00:20:39,280
does that answer your question

531
00:20:43,510 --> 00:20:41,600
yes and no i mean really my problem is

532
00:20:44,630 --> 00:20:43,520
that the new object that you guys have

533
00:20:46,549 --> 00:20:44,640
found

534
00:20:48,310 --> 00:20:46,559
if assuming this is a category of some

535
00:20:51,190 --> 00:20:48,320
sort and you may find other examples at

536
00:20:53,510 --> 00:20:51,200
some point do these objects serve that

537
00:20:55,270 --> 00:20:53,520
stepping stone roll between stellar mass

538
00:20:56,630 --> 00:20:55,280

black holes and supermassive black holes

539
00:20:58,789 --> 00:20:56,640
or do you still need the intermediate

540
00:21:01,270 --> 00:20:58,799
mass black holes and these are in fact a

541
00:21:03,110 --> 00:21:01,280
totally different phenomenon thanks the

542
00:21:04,390 --> 00:21:03,120
intermediate mass black holes are a

543
00:21:07,830 --> 00:21:04,400
different

544
00:21:10,310 --> 00:21:07,840
uh phenomenon than the

545
00:21:12,149 --> 00:21:10,320
pulsar that we are um

546
00:21:13,990 --> 00:21:12,159
announcing today

547
00:21:15,190 --> 00:21:14,000
now they

548
00:21:17,830 --> 00:21:15,200
what we see

549
00:21:21,430 --> 00:21:17,840
in the galaxy is two points of x-ray

550
00:21:23,990 --> 00:21:21,440
light that are about the same brightness

551
00:21:25,350 --> 00:21:24,000
and so one might think oh they're the

552
00:21:26,149 --> 00:21:25,360
same thing

553
00:21:28,789 --> 00:21:26,159
but

554
00:21:30,630 --> 00:21:28,799
what we're announcing is that one of

555
00:21:33,750 --> 00:21:30,640
them contains

556
00:21:36,390 --> 00:21:33,760
uh not not a black hole but a pulsar

557
00:21:38,870 --> 00:21:36,400
so is not this missing link

558
00:21:41,270 --> 00:21:38,880
it's not an intermediate mass black hole

559
00:21:44,870 --> 00:21:41,280
even though it looks like one

560
00:21:47,029 --> 00:21:44,880
and that is really the uh discovery

561
00:21:49,270 --> 00:21:47,039
so thank you sorry to jump in i just

562
00:21:50,950 --> 00:21:49,280
wanted to clarify and add on to the mass

563
00:21:53,830 --> 00:21:50,960

estimate so this is basically saying

564
00:21:55,510 --> 00:21:53,840
that x1 that you see there is about 400

565
00:21:58,070 --> 00:21:55,520
times the mass of our sun well whereas

566
00:22:00,070 --> 00:21:58,080
we're saying that x2 or rather the team

567
00:22:02,230 --> 00:22:00,080
who's announcing us today saying x2

568
00:22:04,310 --> 00:22:02,240
weighs about one to one and a half times

569
00:22:08,310 --> 00:22:04,320
the mass of our sun so these are really

570
00:22:11,830 --> 00:22:10,149
thanks this is jd and once again if you

571
00:22:14,310 --> 00:22:11,840
have a question on the telephone bridge

572
00:22:17,430 --> 00:22:14,320
push the star 1 key and if you'd like to

573
00:22:19,029 --> 00:22:17,440
ask a question and ask nasa just send it

574
00:22:20,230 --> 00:22:19,039
to on your twitter

575
00:22:22,630 --> 00:22:20,240
to

576
00:22:25,590 --> 00:22:22,640
ask nasa we do have a question here from

577
00:22:28,630 --> 00:22:25,600
the social media

578
00:22:31,270 --> 00:22:28,640
what is the spin rate of the new bright

579
00:22:35,669 --> 00:22:31,280
pulsar in m82

580
00:22:39,029 --> 00:22:35,679
yes i can take this it's 1.37

581
00:22:40,710 --> 00:22:39,039
seconds to complete a rotation so

582
00:22:45,270 --> 00:22:40,720
0.7

583
00:22:49,830 --> 00:22:48,549
okay we have a second question here on

584
00:22:53,669 --> 00:22:49,840
social media

585
00:22:55,909 --> 00:22:53,679
is this pulsation from m82 x2 a

586
00:22:59,669 --> 00:22:55,919
transient phenomenon

587
00:23:01,669 --> 00:22:59,679
was was this not observed with suzuka

588
00:23:02,950 --> 00:23:01,679

uh suzaku

589
00:23:05,110 --> 00:23:02,960
h d

590
00:23:07,830 --> 00:23:05,120
hxd

591
00:23:10,710 --> 00:23:07,840
yeah it's most probably a transient

592
00:23:13,430 --> 00:23:10,720
phenomenon because we haven't found

593
00:23:16,310 --> 00:23:13,440
uh evidence for it in uh past

594
00:23:18,630 --> 00:23:16,320
observations for not only suzaku but

595
00:23:20,230 --> 00:23:18,640
many other satellites

596
00:23:23,590 --> 00:23:20,240
um

597
00:23:24,470 --> 00:23:23,600
so and and also in our observations

598
00:23:25,990 --> 00:23:24,480
there's

599
00:23:27,990 --> 00:23:26,000
um

600
00:23:30,950 --> 00:23:28,000
at the start of the observations we

601
00:23:33,909 --> 00:23:30,960
don't see pulsations pulsations start

602
00:23:35,510 --> 00:23:33,919
afterwise and that's actually a very

603
00:23:38,470 --> 00:23:35,520
interesting

604
00:23:40,470 --> 00:23:38,480
feature of this pulsar

605
00:23:41,990 --> 00:23:40,480
yeah and let me clarify a little more

606
00:23:44,870 --> 00:23:42,000
here

607
00:23:46,310 --> 00:23:44,880
the new thing about nustar is that it's

608
00:23:49,270 --> 00:23:46,320
the first

609
00:23:53,270 --> 00:23:49,280
focusing high energy x-ray telescope so

610
00:23:55,350 --> 00:23:53,280
unlike the suzaku hxd

611
00:23:58,390 --> 00:23:55,360
which cannot

612
00:23:59,909 --> 00:23:58,400
resolve the different sources in this

613
00:24:01,750 --> 00:23:59,919

galaxy

614
00:24:04,710 --> 00:24:01,760
so it can't tell the difference between

615
00:24:07,590 --> 00:24:04,720
x1 and x2 nustar is the first

616
00:24:09,669 --> 00:24:07,600
high-energy x-ray telescope that can so

617
00:24:13,269 --> 00:24:09,679
it's the first time we've been able to

618
00:24:15,190 --> 00:24:13,279
separate out the high-energy x-ray light

619
00:24:16,870 --> 00:24:15,200
from these two sources

620
00:24:19,830 --> 00:24:16,880
and study

621
00:24:22,870 --> 00:24:19,840
them and we know that this source x2 is

622
00:24:24,230 --> 00:24:22,880
sometimes very bright and sometimes very

623
00:24:26,549 --> 00:24:24,240
dim

624
00:24:28,470 --> 00:24:26,559
and so it does vary and we think that

625
00:24:30,470 --> 00:24:28,480
when it's bright

626
00:24:32,789 --> 00:24:30,480
that's when you can see these pulsations

627
00:24:35,110 --> 00:24:32,799
but it's really the new kind of x-ray

628
00:24:38,710 --> 00:24:35,120
eyes that nustar has

629
00:24:39,590 --> 00:24:38,720
that has enabled this discovery

630
00:24:42,230 --> 00:24:39,600
all right we're going back to the

631
00:24:44,950 --> 00:24:42,240
telephone bridge yumi our next question

632
00:24:50,230 --> 00:24:44,960
comes from mike wahl from space.com your

633
00:24:53,430 --> 00:24:51,909
okay thank you guys for

634
00:24:55,269 --> 00:24:53,440
for actually doing this this is sort of

635
00:24:57,029 --> 00:24:55,279
i mean a broader question about just

636
00:24:59,590 --> 00:24:57,039
just kind of medium-sized black holes

637
00:25:01,590 --> 00:24:59,600
could you just just take a step back and

638
00:25:03,510 --> 00:25:01,600

and sort of say what you think

639
00:25:05,350 --> 00:25:03,520
is known now about medium-sized black

640
00:25:06,549 --> 00:25:05,360
holes i mean like do we really think

641
00:25:08,470 --> 00:25:06,559
that they exist are they still

642
00:25:10,230 --> 00:25:08,480
hypothetical objects does the

643
00:25:11,350 --> 00:25:10,240
astronomical community

644
00:25:13,110 --> 00:25:11,360
like are they pretty sure that they

645
00:25:14,470 --> 00:25:13,120
exist it's just hard to confirm them i

646
00:25:15,830 --> 00:25:14,480
mean could you just say

647
00:25:17,750 --> 00:25:15,840
just to say a few words about

648
00:25:19,110 --> 00:25:17,760
medium-sized black holes and what kind

649
00:25:20,710 --> 00:25:19,120
of where the

650
00:25:22,310 --> 00:25:20,720
sort of search for them is right now and

651
00:25:24,870 --> 00:25:22,320
like what this new finding means for

652
00:25:29,590 --> 00:25:26,549
okay uh jeanette did you want to take

653
00:25:31,269 --> 00:25:29,600
that or shall i um yeah i'll take it

654
00:25:33,750 --> 00:25:31,279
um

655
00:25:34,630 --> 00:25:33,760
it's been suggested that there should be

656
00:25:38,710 --> 00:25:34,640
these

657
00:25:41,190 --> 00:25:38,720
black holes out there

658
00:25:43,110 --> 00:25:41,200
and most ideas on how to make

659
00:25:44,870 --> 00:25:43,120
supermassive black holes require these

660
00:25:46,390 --> 00:25:44,880
intermediate mass black holes the

661
00:25:49,669 --> 00:25:46,400
problem is that they're very difficult

662
00:25:51,990 --> 00:25:49,679
to find so far there are only maybe two

663
00:25:53,590 --> 00:25:52,000

strong candidates that we have

664
00:25:56,390 --> 00:25:53,600
for these intermediate mass black holes

665
00:25:58,070 --> 00:25:56,400
and one of them is m82 m82x1 which you

666
00:26:02,310 --> 00:25:58,080
can see in the figure gladstone one

667
00:26:07,510 --> 00:26:04,630
this new result

668
00:26:09,590 --> 00:26:07,520
doesn't necessarily impact

669
00:26:11,029 --> 00:26:09,600
the field of intermediate mass back

670
00:26:13,350 --> 00:26:11,039
holes it doesn't necessarily impact the

671
00:26:15,430 --> 00:26:13,360
study for intermediate mass buckles it

672
00:26:17,590 --> 00:26:15,440
does shake up the community that look at

673
00:26:18,950 --> 00:26:17,600
ultraluminous sex resources and those

674
00:26:21,110 --> 00:26:18,960
who are looking at ultraluminous sex

675
00:26:22,710 --> 00:26:21,120
resources are usually looking

676
00:26:25,269 --> 00:26:22,720
for intermediate mass black holes as

677
00:26:27,190 --> 00:26:25,279
well so it will make us stop and think

678
00:26:30,310 --> 00:26:27,200
and look for new options to explain

679
00:26:31,909 --> 00:26:30,320
these strangely bright objects

680
00:26:33,510 --> 00:26:31,919
but as it stands

681
00:26:35,510 --> 00:26:33,520
intermediate mass black holes are very

682
00:26:37,190 --> 00:26:35,520
hard to find

683
00:26:39,590 --> 00:26:37,200
yeah but they are as jeannette says they

684
00:26:42,149 --> 00:26:39,600
are very important because

685
00:26:44,870 --> 00:26:42,159
we believe that they had to exist in the

686
00:26:48,470 --> 00:26:44,880
early universe to be the seeds

687
00:26:49,430 --> 00:26:48,480
from which the very massive black holes

688
00:26:51,190 --> 00:26:49,440

grow

689
00:26:52,470 --> 00:26:51,200
and so

690
00:26:54,549 --> 00:26:52,480
you look at

691
00:26:56,630 --> 00:26:54,559
how do you look for them well one way is

692
00:26:57,830 --> 00:26:56,640
to look for these very bright x-ray

693
00:27:01,350 --> 00:26:57,840
sources

694
00:27:03,350 --> 00:27:01,360
and here x2 has really tricked us

695
00:27:05,909 --> 00:27:03,360
it tricked us into thinking it was

696
00:27:12,070 --> 00:27:05,919
perhaps an intermediate mass black hole

697
00:27:16,230 --> 00:27:13,830
okay we're going back to the

698
00:27:17,669 --> 00:27:16,240
social media sphere here

699
00:27:19,750 --> 00:27:17,679
got another question

700
00:27:23,350 --> 00:27:19,760
do we have any similar objects in our

701
00:27:26,789 --> 00:27:25,430
sure i can take that

702
00:27:29,029 --> 00:27:26,799
yeah there are

703
00:27:31,269 --> 00:27:29,039
similar objects uh

704
00:27:33,590 --> 00:27:31,279
in that there are pulsating neutron

705
00:27:34,950 --> 00:27:33,600
stars in our galaxy

706
00:27:37,430 --> 00:27:34,960
and

707
00:27:39,909 --> 00:27:37,440
we think they work

708
00:27:41,110 --> 00:27:39,919
similarly to this

709
00:27:42,070 --> 00:27:41,120
new

710
00:27:44,470 --> 00:27:42,080
source

711
00:27:47,110 --> 00:27:44,480
the only thing is they're much dimmer

712
00:27:49,350 --> 00:27:47,120
more than 10 times fainter

713
00:27:51,590 --> 00:27:49,360

even the even the very very brightest

714
00:27:52,710 --> 00:27:51,600
ones are more than 10 times fainter than

715
00:27:55,269 --> 00:27:52,720
this

716
00:27:58,070 --> 00:27:55,279
so there's probably some new physics

717
00:27:59,990 --> 00:27:58,080
going on here some new process that we

718
00:28:04,789 --> 00:28:00,000
don't yet understand

719
00:28:07,990 --> 00:28:06,230
all right thanks

720
00:28:09,990 --> 00:28:08,000
uh once again if you have a question you

721
00:28:12,149 --> 00:28:10,000
can push the star one key on your phone

722
00:28:15,110 --> 00:28:12,159
on the telephone bridge or you can send

723
00:28:16,870 --> 00:28:15,120
your question via twitter to

724
00:28:18,710 --> 00:28:16,880
ask nasa

725
00:28:20,470 --> 00:28:18,720
another question here

726
00:28:23,269 --> 00:28:20,480
how difficult was it to make this

727
00:28:27,590 --> 00:28:23,279
observation with nustar how were these

728
00:28:29,190 --> 00:28:27,600
rapid rapid observations taken

729
00:28:31,909 --> 00:28:29,200
well they were not

730
00:28:34,310 --> 00:28:31,919
really rapid observations

731
00:28:36,070 --> 00:28:34,320
it was a single observations in which

732
00:28:39,269 --> 00:28:36,080
you you could

733
00:28:42,470 --> 00:28:39,279
measure the variability of the x-ray

734
00:28:45,830 --> 00:28:42,480
signal in very short time scales

735
00:28:48,389 --> 00:28:45,840
and uh it was i i don't think it was a

736
00:28:50,549 --> 00:28:48,399
very difficult observation for new start

737
00:28:53,269 --> 00:28:50,559
because new star is just

738
00:28:55,669 --> 00:28:53,279

extremely good at doing this kind of

739
00:28:58,389 --> 00:28:55,679
observations

740
00:29:01,190 --> 00:28:58,399
yeah and i'll say that

741
00:29:04,070 --> 00:29:01,200
what's interesting is this is an example

742
00:29:07,269 --> 00:29:04,080
of serendipitous discovery because we

743
00:29:09,510 --> 00:29:07,279
were looking at this cigar galaxy not

744
00:29:13,110 --> 00:29:09,520
to study these ultra-luminous x-ray

745
00:29:15,909 --> 00:29:13,120
sources but to follow up on a supernova

746
00:29:18,549 --> 00:29:15,919
that exploded there and so that's why we

747
00:29:21,029 --> 00:29:18,559
stared at the galaxy for so long

748
00:29:23,830 --> 00:29:21,039
and these sources just happened

749
00:29:27,029 --> 00:29:23,840
to be in you know in the field of view

750
00:29:29,430 --> 00:29:27,039
to be visible in the same image

751
00:29:32,789 --> 00:29:29,440
and so mateo

752
00:29:35,510 --> 00:29:32,799
was looking at them searching for sig

753
00:29:37,590 --> 00:29:35,520
signatures of

754
00:29:39,350 --> 00:29:37,600
massive black holes

755
00:29:40,389 --> 00:29:39,360
and instead

756
00:29:44,870 --> 00:29:40,399
found

757
00:29:45,909 --> 00:29:44,880
this uh pulsing off and on and so it was

758
00:29:47,830 --> 00:29:45,919
really

759
00:29:50,149 --> 00:29:47,840
a surprise it took

760
00:29:55,350 --> 00:29:50,159
us a little while to believe it

761
00:29:59,750 --> 00:29:57,430
we have a question from daniel theory

762
00:30:02,070 --> 00:29:59,760
from science magazine your line is now

763
00:30:04,950 --> 00:30:02,950

hi

764
00:30:06,789 --> 00:30:04,960
i just wanted to ask

765
00:30:08,389 --> 00:30:06,799
uh this

766
00:30:11,510 --> 00:30:08,399
very very luminous

767
00:30:14,710 --> 00:30:11,520
um pulsar have you got any theories

768
00:30:18,870 --> 00:30:14,720
about what process could be creating its

769
00:30:21,350 --> 00:30:20,389
uh mateo do you want to take that or

770
00:30:24,549 --> 00:30:21,360
shall i

771
00:30:28,149 --> 00:30:24,559
oh it's okay i can take it um

772
00:30:32,310 --> 00:30:28,159
there are some theories um

773
00:30:33,430 --> 00:30:32,320
it's at this stage there there's still a

774
00:30:37,350 --> 00:30:33,440
little

775
00:30:41,909 --> 00:30:39,909
such luminosities were not really

776
00:30:45,190 --> 00:30:41,919
thought of a lot

777
00:30:47,510 --> 00:30:45,200
but there are some ways to overcome the

778
00:30:50,870 --> 00:30:47,520
limits that usually exist in the

779
00:30:53,990 --> 00:30:50,880
luminosity of this object and

780
00:30:55,990 --> 00:30:54,000
impulsers there are several things that

781
00:30:57,430 --> 00:30:56,000
might happen

782
00:30:58,630 --> 00:30:57,440
um

783
00:31:01,510 --> 00:30:58,640
and

784
00:31:04,950 --> 00:31:01,520
one includes the fact that this sort

785
00:31:07,590 --> 00:31:04,960
this um this stars have a very strong

786
00:31:09,110 --> 00:31:07,600
magnetic field and this in some way

787
00:31:13,590 --> 00:31:09,120
might happen

788
00:31:16,389 --> 00:31:13,600

time

789
00:31:18,549 --> 00:31:16,399
let's say and so produce a very high

790
00:31:23,269 --> 00:31:18,559
luminosity

791
00:31:26,870 --> 00:31:24,070
as

792
00:31:28,389 --> 00:31:26,880
the fall of the matter is concentrated

793
00:31:31,590 --> 00:31:28,399
in very

794
00:31:34,389 --> 00:31:31,600
small areas

795
00:31:35,430 --> 00:31:34,399
it might somehow uh

796
00:31:37,990 --> 00:31:35,440
be

797
00:31:41,110 --> 00:31:38,000
easier for this matter to fall

798
00:31:43,909 --> 00:31:41,120
undisturbed on the surface so at a very

799
00:31:48,470 --> 00:31:43,919
high velocities very high rate

800
00:31:50,870 --> 00:31:48,480
than in black holes when the when the

801
00:31:52,870 --> 00:31:50,880
the fall of the matter is more more

802
00:31:54,070 --> 00:31:52,880
homogeneous

803
00:31:56,389 --> 00:31:54,080
um

804
00:31:59,190 --> 00:31:56,399
i don't know the the amount of detail

805
00:32:03,110 --> 00:31:59,200
you were asking for

806
00:32:07,110 --> 00:32:05,269
yeah i will say that uh it will it's a

807
00:32:09,190 --> 00:32:07,120
puzzle for theorists because there's a

808
00:32:10,710 --> 00:32:09,200
very famous paper

809
00:32:13,430 --> 00:32:10,720
uh that

810
00:32:15,269 --> 00:32:13,440
uh predicts the brightest

811
00:32:16,789 --> 00:32:15,279
uh that you should be able to see a

812
00:32:19,350 --> 00:32:16,799
pulsar

813
00:32:21,269 --> 00:32:19,360

at and it's more than ten times fainter

814
00:32:23,029 --> 00:32:21,279
than this one so

815
00:32:26,830 --> 00:32:23,039
uh i think there will be new theories

816
00:32:30,549 --> 00:32:28,710
observation right we're going back to

817
00:32:31,430 --> 00:32:30,559
the twitter sphere

818
00:32:34,470 --> 00:32:31,440
uh

819
00:32:36,630 --> 00:32:34,480
what was the spectrum for m82x2 in this

820
00:32:40,070 --> 00:32:36,640
observation what physical model was most

821
00:32:45,509 --> 00:32:43,110
it's quite difficult to determine uh

822
00:32:48,870 --> 00:32:45,519
because there are these two very bright

823
00:32:50,870 --> 00:32:48,880
sources close to each other and new star

824
00:32:55,110 --> 00:32:50,880
cannot resolve them

825
00:32:58,149 --> 00:32:55,120
um spatially okay that's why we used

826
00:33:00,549 --> 00:32:58,159
also other satellites to help

827
00:33:01,669 --> 00:33:00,559
disentangling between the the two bright

828
00:33:04,389 --> 00:33:01,679
sources

829
00:33:06,950 --> 00:33:04,399
and so obtaining a spectrum that has

830
00:33:12,549 --> 00:33:10,710
only x-rays from our source is actually

831
00:33:17,430 --> 00:33:12,559
quite tricky

832
00:33:25,590 --> 00:33:20,630
for now we don't have a result that is

833
00:33:28,789 --> 00:33:27,669
okay another twitter question

834
00:33:30,950 --> 00:33:28,799
does the

835
00:33:32,549 --> 00:33:30,960
accretion rate for the pulsar suggest

836
00:33:34,870 --> 00:33:32,559
that it is accreting from a rich

837
00:33:37,029 --> 00:33:34,880
environment perhaps a nebula or multiple

838
00:33:40,310 --> 00:33:37,039

stars

839
00:33:42,630 --> 00:33:40,320
it's not needed um

840
00:33:45,350 --> 00:33:42,640
the the standard way

841
00:33:48,630 --> 00:33:45,360
uh these kinds of objects accrete that

842
00:33:50,950 --> 00:33:48,640
is feeding off the companion star

843
00:33:52,630 --> 00:33:50,960
can reach this rate

844
00:33:55,190 --> 00:33:52,640
the problem of obtaining high

845
00:33:57,590 --> 00:33:55,200
luminosities is

846
00:33:58,470 --> 00:33:57,600
closer to the compact object

847
00:33:59,350 --> 00:33:58,480
not

848
00:34:02,389 --> 00:33:59,360
uh

849
00:34:03,590 --> 00:34:02,399
the rate at which these objects can

850
00:34:09,589 --> 00:34:03,600
attract

851
00:34:12,629 --> 00:34:11,190
okay once again if you have a question

852
00:34:15,349 --> 00:34:12,639
on the phone bridge you can push the

853
00:34:17,829 --> 00:34:15,359
star one key to put be put in the queue

854
00:34:20,550 --> 00:34:17,839
and for twitter questions use the

855
00:34:22,950 --> 00:34:20,560
hashtag ask nasa

856
00:34:24,470 --> 00:34:22,960
back to twitter right now how does this

857
00:34:27,349 --> 00:34:24,480
new star

858
00:34:29,990 --> 00:34:27,359
finding distinguish between far away and

859
00:34:31,669 --> 00:34:30,000
close-up x-ray sources

860
00:34:34,950 --> 00:34:31,679
how does new star distinguish between

861
00:34:38,950 --> 00:34:34,960
faraway and close-up x-ray sources

862
00:34:40,149 --> 00:34:38,960
so that's a good a very good question um

863
00:34:49,270 --> 00:34:40,159

the

864
00:34:51,829 --> 00:34:49,280
in this galaxy

865
00:34:53,909 --> 00:34:51,839
the cigar galaxy and we know how far

866
00:34:55,030 --> 00:34:53,919
away that galaxy is

867
00:34:58,069 --> 00:34:55,040
and we know

868
00:35:01,270 --> 00:34:58,079
both x1 and x2 are embedded in this

869
00:35:03,829 --> 00:35:01,280
galaxy because in the low energy part of

870
00:35:04,950 --> 00:35:03,839
the x-ray

871
00:35:07,910 --> 00:35:04,960
spectrum

872
00:35:11,030 --> 00:35:07,920
for low energy x-rays we see

873
00:35:13,670 --> 00:35:11,040
those x-rays may dimmer

874
00:35:14,870 --> 00:35:13,680
but because they are absorbed by the

875
00:35:17,510 --> 00:35:14,880
dust and

876
00:35:18,870 --> 00:35:17,520
gas in this galaxy so we know the

877
00:35:20,790 --> 00:35:18,880
sources

878
00:35:22,790 --> 00:35:20,800
are in this

879
00:35:26,710 --> 00:35:22,800
this galaxy and we know the distance to

880
00:35:30,790 --> 00:35:28,069
all right thanks

881
00:35:33,030 --> 00:35:30,800
we have another twitter question here

882
00:35:38,310 --> 00:35:33,040
how many other objects like this one are

883
00:35:42,310 --> 00:35:40,870
matteo do you want to take that

884
00:35:43,270 --> 00:35:42,320
uh

885
00:35:46,069 --> 00:35:43,280
well

886
00:35:49,670 --> 00:35:46,079
that that's the question right uh now we

887
00:35:51,589 --> 00:35:49,680
found one and uh it's possible that this

888
00:35:53,990 --> 00:35:51,599

one is an oddball

889
00:35:57,190 --> 00:35:54,000
or it might be possible that there are

890
00:35:59,750 --> 00:35:57,200
others of course we the the next step is

891
00:36:05,030 --> 00:35:59,760
to look for pulsars in other

892
00:36:10,790 --> 00:36:07,910
right so this this is something we don't

893
00:36:16,790 --> 00:36:10,800
really know as mateo said and nustar is

894
00:36:21,430 --> 00:36:19,349
okay once again uh if you have a

895
00:36:22,310 --> 00:36:21,440
question on the phone bridge use star

896
00:36:25,270 --> 00:36:22,320
one

897
00:36:27,190 --> 00:36:25,280
and for twitter use

898
00:37:01,270 --> 00:36:27,200
nasa we'll stand by for just a moment

899
00:37:04,230 --> 00:37:02,790
we have a question that came in via

900
00:37:05,510 --> 00:37:04,240
email

901
00:37:07,670 --> 00:37:05,520
can the object

902
00:37:09,990 --> 00:37:07,680
accrete sufficient mass

903
00:37:16,390 --> 00:37:13,030
collapse into a black hole if this may

904
00:37:18,150 --> 00:37:16,400
happen any idea on the time frame

905
00:37:19,030 --> 00:37:18,160
that's a really good question and in

906
00:37:21,670 --> 00:37:19,040
fact

907
00:37:22,630 --> 00:37:21,680
that is a prediction

908
00:37:25,109 --> 00:37:22,640
if

909
00:37:29,829 --> 00:37:27,430
pulsar is

910
00:37:31,670 --> 00:37:29,839
accreting matter or mat eating matter at

911
00:37:34,310 --> 00:37:31,680
the rate that we think

912
00:37:36,230 --> 00:37:34,320
it shouldn't last that long before it

913
00:37:38,710 --> 00:37:36,240

turns into a black hole now that won't

914
00:37:41,190 --> 00:37:38,720
happen in our lifetime

915
00:37:42,950 --> 00:37:41,200
but it will happen

916
00:37:43,750 --> 00:37:42,960
uh on a

917
00:37:46,950 --> 00:37:43,760
what

918
00:37:48,630 --> 00:37:46,960
on a relatively short time scale uh in

919
00:37:50,630 --> 00:37:48,640
terms of

920
00:37:55,829 --> 00:37:50,640
the age of this galaxy and the age of

921
00:38:01,109 --> 00:37:57,270
do we know what size the black hole

922
00:38:03,829 --> 00:38:01,870
well

923
00:38:07,190 --> 00:38:03,839
approximately

924
00:38:09,190 --> 00:38:07,200
when something becomes more than a few

925
00:38:11,670 --> 00:38:09,200
times the mass of the sun

926
00:38:14,069 --> 00:38:11,680
the uh it can no longer

927
00:38:16,310 --> 00:38:14,079
be a neutron star it collapses into a

928
00:38:30,310 --> 00:38:16,320
black hole so it would be a few few

929
00:38:33,430 --> 00:38:31,430
i'm sorry

930
00:38:35,910 --> 00:38:33,440
now we got a question from twitter

931
00:38:38,710 --> 00:38:35,920
rather generic what how well is nustar

932
00:38:41,750 --> 00:38:38,720
doing after two years in space and uh

933
00:38:43,109 --> 00:38:41,760
what's next to come for it

934
00:38:45,910 --> 00:38:43,119
well uh

935
00:38:47,990 --> 00:38:45,920
so nustar has just finished what's

936
00:38:49,750 --> 00:38:48,000
called its baseline mission

937
00:38:50,630 --> 00:38:49,760
uh that was the mission

938
00:38:52,630 --> 00:38:50,640

uh

939
00:38:55,030 --> 00:38:52,640
two two years

940
00:38:56,310 --> 00:38:55,040
and has just been turned over to the

941
00:38:59,750 --> 00:38:56,320
community

942
00:39:02,790 --> 00:38:59,760
for two years where anyone

943
00:39:04,550 --> 00:39:02,800
in the world can propose to look at

944
00:39:07,109 --> 00:39:04,560
something with nustar that's called a

945
00:39:09,750 --> 00:39:07,119
guest investigator program

946
00:39:11,829 --> 00:39:09,760
and so nustar is very healthy the

947
00:39:12,630 --> 00:39:11,839
satellite is still working as well as it

948
00:39:13,750 --> 00:39:12,640
did

949
00:39:15,349 --> 00:39:13,760
the day

950
00:39:17,829 --> 00:39:15,359
after it launched

951
00:39:19,990 --> 00:39:17,839
and we hope that there will be

952
00:39:23,750 --> 00:39:20,000
many more years

953
00:39:25,510 --> 00:39:23,760
of guest investigator programs where

954
00:39:30,150 --> 00:39:25,520
people from around the world can use

955
00:39:34,550 --> 00:39:32,630
all right one last time uh if you have a

956
00:39:38,150 --> 00:39:34,560
question from the telephone bridge

957
00:39:39,670 --> 00:39:38,160
star one on your phone and ask nasa

958
00:39:52,470 --> 00:39:39,680
we'll be closing down in just a moment

959
00:39:55,349 --> 00:39:53,670
all right i guess that's going to do it

960
00:39:57,109 --> 00:39:55,359
for today's news telecon i'd like to

961
00:39:59,349 --> 00:39:57,119
thank the panelists and our operator

962
00:40:01,109 --> 00:39:59,359
yumi for their time today i asked

963
00:40:03,030 --> 00:40:01,119

panelists stay online for just a few

964
00:40:04,630 --> 00:40:03,040
minutes for post follow-up

965
00:40:05,990 --> 00:40:04,640
and for the listeners our panelists will

966
00:40:07,750 --> 00:40:06,000
stay behind and answer any other

967
00:40:10,630 --> 00:40:07,760
questions that pop up on twitter's

968
00:40:12,550 --> 00:40:10,640
hashtag ask nasa forum if you join this

969
00:40:17,270 --> 00:40:12,560
telecon late you can listen to it again

970
00:40:17,280 --> 00:40:21,829
that number again is 1-800-839-1248

971
00:40:25,829 --> 00:40:23,750
to find out more about these findings or

972
00:40:28,310 --> 00:40:25,839
for more info on any of nasa's many

973
00:40:31,270 --> 00:40:28,320
programs and projects visit us on the

974
00:40:33,829 --> 00:40:31,280
web at www.nasa.gov

975
00:40:36,230 --> 00:40:33,839
or via our many social media venues such

976
00:40:38,150 --> 00:40:36,240
as facebook google plus twitter youtube

977
00:40:40,790 --> 00:40:38,160
and many more once again thanks for

978
00:40:42,390 --> 00:40:40,800
joining us and have a great day

979
00:40:44,310 --> 00:40:42,400
thank you for your participation you may