

1  
00:00:01,760 --> 00:00:07,048  
one hello everybody we're back it's only

2  
00:00:05,639 --> 00:00:09,058  
been eight minutes this would be the

3  
00:00:07,049 --> 00:00:10,589  
last one but we're back again I'm Tony

4  
00:00:09,058 --> 00:00:12,570  
Darnell organ space telescope sizes you

5  
00:00:10,589 --> 00:00:15,349  
and this is carol christian we're back

6  
00:00:12,570 --> 00:00:18,448  
doing a meeting recap of the double the

7  
00:00:15,349 --> 00:00:21,028  
225th meeting of the double-a s we're at

8  
00:00:18,449 --> 00:00:22,439  
our booth and we are doing a lot of

9  
00:00:21,028 --> 00:00:23,339  
things here at this meeting and one of

10  
00:00:22,439 --> 00:00:24,689  
the things we're doing its really

11  
00:00:23,339 --> 00:00:26,609  
interesting i have two members of the

12  
00:00:24,689 --> 00:00:28,768  
staff that the institute with me i have

13  
00:00:26,609 --> 00:00:30,359  
Tony Tony Rogers and Lee quick they're

14  
00:00:28,768 --> 00:00:32,429  
both working on something that I want to

15  
00:00:30,359 --> 00:00:35,489  
make you guys aware of because I know

16  
00:00:32,429 --> 00:00:38,488  
you want to get Hubble data and right

17  
00:00:35,488 --> 00:00:41,909  
now to do it you use the makoki Mikulski

18  
00:00:38,488 --> 00:00:43,919  
archive or space telescopes and that's

19  
00:00:41,909 --> 00:00:46,378  
right ma st right we call it mass and

20  
00:00:43,920 --> 00:00:49,109  
you get there with at mass dot stsci edu

21  
00:00:46,378 --> 00:00:52,289  
right yes and you type in things and you

22  
00:00:49,109 --> 00:00:53,878  
get data out but where but what Tony and

23  
00:00:52,289 --> 00:00:56,340  
Lee are here demonstrating at the

24  
00:00:53,878 --> 00:00:58,530  
meeting at the booth here this this week

25  
00:00:56,340 --> 00:01:01,590  
is a new interface that makes it easier

26  
00:00:58,530 --> 00:01:02,879  
for you to get Hubble data and so it's

27  
00:01:01,590 --> 00:01:05,159  
he's going to give us a quick

28  
00:01:02,878 --> 00:01:07,859  
demonstration of it and then we're going

29

00:01:05,159 --> 00:01:10,650  
to follow up in February I believe with

30  
00:01:07,859 --> 00:01:12,719  
when Denise gets released with a longer

31  
00:01:10,650 --> 00:01:16,130  
hang out that really goes in-depth it

32  
00:01:12,719 --> 00:01:18,900  
shows you how to use it and get specific

33  
00:01:16,129 --> 00:01:21,149  
data sets out of the archive and it's

34  
00:01:18,900 --> 00:01:27,170  
not just Hubble is it it's also it's got

35  
00:01:21,150 --> 00:01:30,380  
Hubble GALEX iue fuse Kepler many others

36  
00:01:27,170 --> 00:01:32,969  
so it's a one-stop shop for all the

37  
00:01:30,379 --> 00:01:34,289  
visible and UV data that's in our

38  
00:01:32,969 --> 00:01:35,849  
holdings that's right and we've got

39  
00:01:34,290 --> 00:01:37,290  
other missions coming online as well in

40  
00:01:35,849 --> 00:01:38,578  
the future and as they are added they

41  
00:01:37,290 --> 00:01:40,049  
will also be accessible through this

42  
00:01:38,578 --> 00:01:41,728  
interface so i'm going to i'm going to

43  
00:01:40,049 --> 00:01:43,470

go back and drive the camera because i

44

00:01:41,728 --> 00:01:46,849

want to zoom in on it while Tony tells

45

00:01:43,469 --> 00:01:46,849

us Tony Lee tell us about what they got

46

00:01:47,450 --> 00:01:51,930

so I was going to comment that one of

47

00:01:50,340 --> 00:01:54,359

the reasons that we have these

48

00:01:51,930 --> 00:01:58,350

demonstrations is because we have a lot

49

00:01:54,359 --> 00:02:00,868

of the science community here and the

50

00:01:58,349 --> 00:02:03,449

idea is to introduce these interfaces

51

00:02:00,868 --> 00:02:05,790

and the tools that Hubble offers to the

52

00:02:03,450 --> 00:02:08,459

community get their feedback make sure

53

00:02:05,790 --> 00:02:10,530

that they are aware that these tools

54

00:02:08,459 --> 00:02:12,930

exist and then if they have specific

55

00:02:10,530 --> 00:02:13,530

questions we have people like Tony and

56

00:02:12,930 --> 00:02:16,620

leave

57

00:02:13,530 --> 00:02:18,780

here to answer them and that helps us

58  
00:02:16,620 --> 00:02:22,560  
improve the system and also it's a great

59  
00:02:18,780 --> 00:02:24,568  
way for us to let them get hands-on with

60  
00:02:22,560 --> 00:02:26,849  
the tools so at this point we're going

61  
00:02:24,568 --> 00:02:29,429  
to have Tony and me talk about this new

62  
00:02:26,849 --> 00:02:31,829  
tool and how an astronomer a dumb

63  
00:02:29,430 --> 00:02:36,989  
astronomer like me could use it to get

64  
00:02:31,830 --> 00:02:39,569  
some data out of the archive Mike and

65  
00:02:36,989 --> 00:02:41,759  
then you can drive all right so I've

66  
00:02:39,568 --> 00:02:50,639  
loaded the mass website right here on

67  
00:02:41,759 --> 00:02:55,799  
our browser I go to that side okay all

68  
00:02:50,639 --> 00:02:58,969  
right and the URL is masked at SESC ided

69  
00:02:55,800 --> 00:03:02,010  
you but you can also get it from the

70  
00:02:58,969 --> 00:03:04,409  
archive classic page just by entering

71  
00:03:02,009 --> 00:03:07,530  
your favorite target right here right in

72  
00:03:04,409 --> 00:03:10,229  
the main archived at st SE I to edu and

73  
00:03:07,530 --> 00:03:13,860  
then that will launch you over to the

74  
00:03:10,229 --> 00:03:21,929  
mast portal page so what I'm going to do

75  
00:03:13,860 --> 00:03:24,840  
I can find my cursor and it will launch

76  
00:03:21,930 --> 00:03:26,730  
you to this interface right here this is

77  
00:03:24,840 --> 00:03:29,069  
a new interface once again it's a

78  
00:03:26,729 --> 00:03:31,199  
one-stop shop for all the holdings

79  
00:03:29,069 --> 00:03:33,539  
within the archive so I'm going to just

80  
00:03:31,199 --> 00:03:35,819  
do a simple search what we call a

81  
00:03:33,539 --> 00:03:37,828  
positional search Scott is your kind of

82  
00:03:35,819 --> 00:03:40,859  
your bread and butter way to find your

83  
00:03:37,829 --> 00:03:43,349  
data in the archive the interface is

84  
00:03:40,860 --> 00:03:45,840  
very interactive it's really an

85  
00:03:43,349 --> 00:03:47,370  
application it's not necessarily a web

86

00:03:45,840 --> 00:03:50,219  
page so you don't want to hit the back

87  
00:03:47,370 --> 00:03:52,920  
button you'll lose all context here this

88  
00:03:50,219 --> 00:03:56,669  
is a single page app you just stay here

89  
00:03:52,919 --> 00:03:58,828  
and work within your data so i just

90  
00:03:56,669 --> 00:04:01,679  
searched m60 right here and you can see

91  
00:03:58,829 --> 00:04:03,750  
i got quite a few observations that came

92  
00:04:01,680 --> 00:04:08,120  
out of the archive and if i can lift my

93  
00:04:03,750 --> 00:04:11,189  
glasses there we go how many 31 anyone

94  
00:04:08,120 --> 00:04:13,230  
371 observations and they're across many

95  
00:04:11,189 --> 00:04:16,949  
mission so if you can see right down

96  
00:04:13,229 --> 00:04:20,279  
here you've got HST Hubble can you read

97  
00:04:16,949 --> 00:04:23,038  
this all for melee Swift GALEX iue and

98  
00:04:20,279 --> 00:04:25,019  
Hut okay so what I'm going to do is I'm

99  
00:04:23,038 --> 00:04:26,159  
just going to down sample to Hubble

100  
00:04:25,019 --> 00:04:30,000

right here

101

00:04:26,160 --> 00:04:32,939

and the Hubble is sort of the flagship

102

00:04:30,000 --> 00:04:35,459

mission so what you may have seen is

103

00:04:32,939 --> 00:04:37,500

that so we even explained to you and

104

00:04:35,459 --> 00:04:39,930

they're about to is that these are where

105

00:04:37,500 --> 00:04:42,089

the observations are an m60 is behind

106

00:04:39,930 --> 00:04:43,860

here so if you google m60 you'll see

107

00:04:42,089 --> 00:04:47,849

what an image of that galaxy looks like

108

00:04:43,860 --> 00:04:50,250

and and when he just selected HST that's

109

00:04:47,850 --> 00:04:51,570

all that's left the other things that

110

00:04:50,250 --> 00:04:54,240

were on there were the other

111

00:04:51,569 --> 00:04:56,399

observatories that had observed it well

112

00:04:54,240 --> 00:04:58,410

said so yeah we filtered down all of the

113

00:04:56,399 --> 00:05:00,569

records and we're not just looking at

114

00:04:58,410 --> 00:05:05,310

the Hubble records right now in the grid



115  
00:05:00,569 --> 00:05:07,170  
and over on the sky view same thing just

116  
00:05:05,310 --> 00:05:09,360  
the week we call these footprints

117  
00:05:07,170 --> 00:05:12,420  
through the outline of each aperture on

118  
00:05:09,360 --> 00:05:15,870  
the sky and this way you just can't have

119  
00:05:12,420 --> 00:05:17,310  
a context you can keep in context of the

120  
00:05:15,870 --> 00:05:20,939  
data you're interested in so I'm going

121  
00:05:17,310 --> 00:05:30,180  
to down sample a little bit more for

122  
00:05:20,939 --> 00:05:31,829  
example if I wanted so wait so okay boys

123  
00:05:30,180 --> 00:05:35,160  
and girls does anybody know what that

124  
00:05:31,829 --> 00:05:38,039  
shape is that's a wide field planetary

125  
00:05:35,160 --> 00:05:40,290  
camera 2 that's the old instruments or

126  
00:05:38,040 --> 00:05:44,610  
some of these are the older observation

127  
00:05:40,290 --> 00:05:46,470  
so you know that from the classic wedge

128  
00:05:44,610 --> 00:05:49,230  
shape and so you can tell right away

129  
00:05:46,470 --> 00:05:50,730  
that with pic 2 has taken observations

130  
00:05:49,230 --> 00:05:54,000  
and there are many many more

131  
00:05:50,730 --> 00:05:56,069  
observations if we scroll down correct

132  
00:05:54,000 --> 00:05:58,860  
so do you want to filter on with pick

133  
00:05:56,069 --> 00:06:05,099  
two no no I want new stuff new stuff

134  
00:05:58,860 --> 00:06:10,830  
okay whoopsie 3i our brand brand new

135  
00:06:05,100 --> 00:06:14,189  
instrument since 2009 okay all right now

136  
00:06:10,829 --> 00:06:17,579  
you're looking at just the whiff c3i our

137  
00:06:14,189 --> 00:06:19,079  
observations taken around m60 and you

138  
00:06:17,579 --> 00:06:21,959  
can see a downsampled I should mention

139  
00:06:19,079 --> 00:06:24,810  
over here on the right the red dashed

140  
00:06:21,959 --> 00:06:27,810  
circle represents our search radius and

141  
00:06:24,810 --> 00:06:29,850  
in the center that's there's also a

142  
00:06:27,810 --> 00:06:33,899  
crosshair representing the the actual

143

00:06:29,850 --> 00:06:37,680  
center point of our search and this was

144  
00:06:33,899 --> 00:06:39,959  
resolved up here when I entered m60 the

145  
00:06:37,680 --> 00:06:42,418  
magic happens where names are resolved

146  
00:06:39,959 --> 00:06:43,620  
physicians and all the software takes

147  
00:06:42,418 --> 00:06:44,459  
care of that for you just have to

148  
00:06:43,620 --> 00:06:47,310  
remember the name of your favorite

149  
00:06:44,459 --> 00:06:49,469  
target so at this point let's say I just

150  
00:06:47,310 --> 00:06:50,879  
want these observations around the

151  
00:06:49,470 --> 00:06:52,710  
center of the galaxy and I don't really

152  
00:06:50,879 --> 00:06:54,360  
want that one on the edge if you've

153  
00:06:52,709 --> 00:06:56,848  
noticed I'm getting a little hover

154  
00:06:54,360 --> 00:06:58,680  
action when the mouse goes over that it

155  
00:06:56,848 --> 00:07:00,870  
gets slightly brighter that means it's

156  
00:06:58,680 --> 00:07:03,750  
selectable so i went ahead and selected

157  
00:07:00,870 --> 00:07:06,509

those and the footprint is now brighter

158

00:07:03,750 --> 00:07:09,660

in color indicating selection and over

159

00:07:06,509 --> 00:07:12,270

here on the grid they were also selected

160

00:07:09,660 --> 00:07:14,820

they went blue and the far left checkbox

161

00:07:12,269 --> 00:07:16,740

is indicating that they're selected so

162

00:07:14,819 --> 00:07:19,709

if you were just going straight through

163

00:07:16,740 --> 00:07:21,210

and you wanted to get out and get back

164

00:07:19,709 --> 00:07:23,339

on with your life as quickly as possible

165

00:07:21,209 --> 00:07:27,569

you would just come up here and just add

166

00:07:23,339 --> 00:07:31,439

all of those selected records to what we

167

00:07:27,569 --> 00:07:33,800

call the download basket and right now

168

00:07:31,439 --> 00:07:38,990

how many do we have there Lee how many

169

00:07:33,800 --> 00:07:42,629

33 files really good Lee you're doing

170

00:07:38,990 --> 00:07:45,720

doing really well cuz we can't read it

171

00:07:42,629 --> 00:07:51,538

back here sup we have no idea you can

172  
00:07:45,720 --> 00:07:55,650  
tell us 105 1000 via you just do one

173  
00:07:51,538 --> 00:07:58,829  
price yeah thank you van anis leave Anna

174  
00:07:55,649 --> 00:08:01,529  
all right Janice from the prices yeah ok

175  
00:07:58,829 --> 00:08:03,478  
so I'm going to select all of these

176  
00:08:01,529 --> 00:08:08,609  
files these are actual files at this

177  
00:08:03,478 --> 00:08:12,240  
greeting aren't you yes and you can now

178  
00:08:08,610 --> 00:08:16,110  
save them directly to your hard drive

179  
00:08:12,240 --> 00:08:17,939  
and the download basket lets you decide

180  
00:08:16,110 --> 00:08:20,879  
do you want to bundle than one giant

181  
00:08:17,939 --> 00:08:23,519  
tard gzip or do you want to save it as a

182  
00:08:20,879 --> 00:08:26,810  
double you get or curl script I'm just

183  
00:08:23,519 --> 00:08:30,359  
going to keep the default and I'm gonna

184  
00:08:26,810 --> 00:08:32,519  
it's now bundling up that tar and then

185  
00:08:30,360 --> 00:08:34,050  
when it completes you'll see it chrome

186  
00:08:32,519 --> 00:08:39,208  
will automatically download it to my

187  
00:08:34,049 --> 00:08:41,129  
downloads directory so something's

188  
00:08:39,208 --> 00:08:44,829  
happening this is good we're at

189  
00:08:41,129 --> 00:08:47,590  
thirty-nine percent complete so um

190  
00:08:44,830 --> 00:08:50,290  
while this is happening I can sew sew

191  
00:08:47,590 --> 00:08:53,440  
sew a question so just to make sure

192  
00:08:50,289 --> 00:08:55,569  
people understand this data is not here

193  
00:08:53,440 --> 00:08:59,200  
it's gone reaching back to Space

194  
00:08:55,570 --> 00:09:01,300  
Telescope and getting the data finding

195  
00:08:59,200 --> 00:09:03,250  
it and then pulling it right here so you

196  
00:09:01,299 --> 00:09:04,750  
could work on it if you want all right

197  
00:09:03,250 --> 00:09:07,179  
yes and if you look down here in the

198  
00:09:04,750 --> 00:09:09,070  
very bottom corner vegan Tony dornell

199  
00:09:07,179 --> 00:09:12,429  
consuming that's basically here's my

200

00:09:09,070 --> 00:09:14,730  
tard cheesy nicely and it's ready to be

201  
00:09:12,429 --> 00:09:17,799  
opened up on your local hard drive and

202  
00:09:14,730 --> 00:09:20,050  
it's got fits files it's got catalog

203  
00:09:17,799 --> 00:09:22,659  
files it's got everything that masked

204  
00:09:20,049 --> 00:09:30,549  
essentially knows about the very center

205  
00:09:22,659 --> 00:09:36,370  
of that observation so so this is what I

206  
00:09:30,549 --> 00:09:39,729  
call crystal life yeah okay are you did

207  
00:09:36,370 --> 00:09:41,950  
a great job this is the bread and butter

208  
00:09:39,730 --> 00:09:44,350  
passed through the app you basically

209  
00:09:41,950 --> 00:09:46,390  
positional search down select what

210  
00:09:44,350 --> 00:09:49,420  
you're interested in added to the cart

211  
00:09:46,389 --> 00:09:51,340  
save it to the disk there are many many

212  
00:09:49,419 --> 00:09:54,129  
other features that are continuing to

213  
00:09:51,340 --> 00:09:58,300  
grow and in February will demonstrate

214  
00:09:54,129 --> 00:10:01,629

those and the real goal is to push this

215

00:09:58,299 --> 00:10:03,399

entire application more to behave more

216

00:10:01,629 --> 00:10:05,590

like a desktop application and you'll

217

00:10:03,399 --> 00:10:07,299

see in February the types of things

218

00:10:05,590 --> 00:10:09,600

we're talking about where we'll be doing

219

00:10:07,299 --> 00:10:13,240

sort of pre analysis we can create

220

00:10:09,600 --> 00:10:17,740

color-magnitude diagram you can load up

221

00:10:13,240 --> 00:10:20,620

spectral plots directly in the tool you

222

00:10:17,740 --> 00:10:24,190

can overlay these high-resolution images

223

00:10:20,620 --> 00:10:27,820

into the sky and over plot catalogs so

224

00:10:24,190 --> 00:10:31,180

it's just onward and upward so I know a

225

00:10:27,820 --> 00:10:32,830

lot of you use the hub the archive now

226

00:10:31,179 --> 00:10:34,139

and you've made some beautiful images

227

00:10:32,830 --> 00:10:36,370

with it some of you are doing amateur

228

00:10:34,139 --> 00:10:37,929

astronomy with it some of you were



229  
00:10:36,370 --> 00:10:40,210  
making artwork with it i know there's

230  
00:10:37,929 --> 00:10:42,789  
several several people that visit our

231  
00:10:40,210 --> 00:10:44,350  
hangouts regularly who are even big fans

232  
00:10:42,789 --> 00:10:48,159  
of Zolt who you know do the image

233  
00:10:44,350 --> 00:10:50,590  
processing and so if you've used the

234  
00:10:48,159 --> 00:10:52,719  
archive before this promises to be a

235  
00:10:50,590 --> 00:10:54,730  
heck of a lot easier right that's

236  
00:10:52,720 --> 00:10:57,190  
correct and that's the feedback we get

237  
00:10:54,730 --> 00:10:58,310  
from a place like this when we show it

238  
00:10:57,190 --> 00:11:00,440  
to people they

239  
00:10:58,309 --> 00:11:02,149  
they stop what they're doing they go wow

240  
00:11:00,440 --> 00:11:04,100  
and then they go tell their colleagues

241  
00:11:02,149 --> 00:11:06,199  
and they say okay this is what you got

242  
00:11:04,100 --> 00:11:08,629  
it you got to see this so that's good

243  
00:11:06,200 --> 00:11:11,028  
feedback from us we usually just hear

244  
00:11:08,629 --> 00:11:13,159  
negative feedback back in the shop you

245  
00:11:11,028 --> 00:11:16,039  
know but it's good to hear the you know

246  
00:11:13,159 --> 00:11:18,889  
the user community actually appreciate

247  
00:11:16,039 --> 00:11:21,379  
the effort and I think and it's not just

248  
00:11:18,889 --> 00:11:23,689  
us the you know other facilities also

249  
00:11:21,379 --> 00:11:26,088  
using the web's changing and that's what

250  
00:11:23,690 --> 00:11:28,430  
makes all this possible no we talk a lot

251  
00:11:26,089 --> 00:11:29,630  
about telescopes getting bigger being

252  
00:11:28,429 --> 00:11:31,250  
able to see things we can't see now

253  
00:11:29,629 --> 00:11:33,049  
higher resolutions further back in the

254  
00:11:31,250 --> 00:11:35,120  
universe things like that this is the

255  
00:11:33,049 --> 00:11:36,769  
other side of the problem you need to

256  
00:11:35,120 --> 00:11:38,839  
not only be able to take this data but

257

00:11:36,769 --> 00:11:41,028  
you've got to be able to ask good

258  
00:11:38,839 --> 00:11:43,550  
science questions of the data once you

259  
00:11:41,028 --> 00:11:45,559  
have it and that problem is going to get

260  
00:11:43,549 --> 00:11:48,109  
worse and more we're not worth just

261  
00:11:45,559 --> 00:11:50,000  
bigger and these kinds of solutions are

262  
00:11:48,110 --> 00:11:52,190  
going to be more important so it's good

263  
00:11:50,000 --> 00:11:54,200  
that we've got an easier interface into

264  
00:11:52,190 --> 00:11:56,210  
our into our archive because you'll want

265  
00:11:54,200 --> 00:11:57,770  
to be able to get the stuff as easy as

266  
00:11:56,210 --> 00:11:59,920  
you can because there's so much to

267  
00:11:57,769 --> 00:12:04,389  
choose from so you want to say something

268  
00:11:59,919 --> 00:12:04,389  
yes that's why I'm taking the microphone

269  
00:12:04,659 --> 00:12:09,439  
so in addition to the observer who might

270  
00:12:07,789 --> 00:12:11,389  
have said oh I want to look at this and

271  
00:12:09,440 --> 00:12:13,420

one time which we've talked about

272

00:12:11,389 --> 00:12:16,220

several times before how do you get

273

00:12:13,419 --> 00:12:18,259

telescope time then they want to get

274

00:12:16,220 --> 00:12:20,180

their own data as well as data from

275

00:12:18,259 --> 00:12:24,169

other telescopes and use that for

276

00:12:20,179 --> 00:12:26,120

analysis but then after they've done

277

00:12:24,169 --> 00:12:28,338

some of their own analysis probably

278

00:12:26,120 --> 00:12:31,250

published a paper anybody than community

279

00:12:28,339 --> 00:12:35,270

can get the data and do new studies and

280

00:12:31,250 --> 00:12:38,419

in fact most not most but more than half

281

00:12:35,269 --> 00:12:41,000

of the the published papers come from

282

00:12:38,419 --> 00:12:43,219

the archive not from the original

283

00:12:41,000 --> 00:12:45,769

observer and that's because these

284

00:12:43,220 --> 00:12:47,690

observations can be used for many many

285

00:12:45,769 --> 00:12:49,490

many problems to look at different

286  
00:12:47,690 --> 00:12:51,620  
things about astrophysics so the

287  
00:12:49,490 --> 00:12:53,779  
original observer wanted to do a certain

288  
00:12:51,620 --> 00:12:55,580  
thing and other people want to do other

289  
00:12:53,779 --> 00:12:58,220  
things in combined data in different

290  
00:12:55,580 --> 00:13:00,800  
ways so that's why the archive is so

291  
00:12:58,220 --> 00:13:03,740  
powerful is that we're getting a lot

292  
00:13:00,799 --> 00:13:06,019  
more science by having this archive then

293  
00:13:03,740 --> 00:13:07,669  
rather than just shipping one data set

294  
00:13:06,019 --> 00:13:09,500  
to one observer

295  
00:13:07,669 --> 00:13:11,569  
not to mention I'll just mention the

296  
00:13:09,500 --> 00:13:13,519  
time factor the fact that Hubble has

297  
00:13:11,570 --> 00:13:16,790  
gone back and observe a lot of these

298  
00:13:13,519 --> 00:13:18,079  
targets now over 20 years you can really

299  
00:13:16,789 --> 00:13:21,799  
start to see things like they're like

300  
00:13:18,080 --> 00:13:23,870  
I'm 16 yeah yeah like variability and

301  
00:13:21,799 --> 00:13:26,269  
things like this are real interesting

302  
00:13:23,870 --> 00:13:28,190  
yeah so you can sort of see that and

303  
00:13:26,269 --> 00:13:29,809  
will show that in February you can

304  
00:13:28,190 --> 00:13:32,510  
actually see that directly out of the

305  
00:13:29,809 --> 00:13:34,939  
archive and find some very interesting

306  
00:13:32,509 --> 00:13:36,590  
very variable sources right there was a

307  
00:13:34,940 --> 00:13:38,180  
time when you know we this this new

308  
00:13:36,590 --> 00:13:39,560  
relatively new term of transient

309  
00:13:38,179 --> 00:13:41,299  
astronomy is now going on where you

310  
00:13:39,559 --> 00:13:43,219  
could see transients events happening

311  
00:13:41,299 --> 00:13:44,870  
and make animations of seems like

312  
00:13:43,220 --> 00:13:47,629  
supernovas and stuff so it's really an

313  
00:13:44,870 --> 00:13:49,429  
amazing time so we will probably have a

314

00:13:47,629 --> 00:13:50,659  
more what we know we will have a more

315  
00:13:49,429 --> 00:13:52,129  
detailed hang out when it's gets

316  
00:13:50,659 --> 00:13:54,110  
released so look for that Carol and I

317  
00:13:52,129 --> 00:13:55,850  
will well let everybody know when that

318  
00:13:54,110 --> 00:13:57,740  
happens sometime probably in February

319  
00:13:55,850 --> 00:13:59,090  
good work this is exciting i can't wait

320  
00:13:57,740 --> 00:14:01,129  
till this comes live so that's really

321  
00:13:59,090 --> 00:14:02,720  
cool okay Angie alright so now what

322  
00:14:01,129 --> 00:14:04,250  
Carolyn are going to do is go over to

323  
00:14:02,720 --> 00:14:06,670  
this table and finish up what we were

324  
00:14:04,250 --> 00:14:06,669  
going to talk about

325  
00:14:10,850 --> 00:14:21,449  
because see how easy that was okay all

326  
00:14:17,039 --> 00:14:23,458  
right yeah we don't need that okay so

327  
00:14:21,448 --> 00:14:25,139  
that is the muck that's the archive

328  
00:14:23,458 --> 00:14:26,849

update and that was that's something

329

00:14:25,139 --> 00:14:28,379

that I've been dying to get you guys

330

00:14:26,850 --> 00:14:31,439

access to so hopefully you'll be getting

331

00:14:28,379 --> 00:14:34,528

that soon the meeting today has been

332

00:14:31,438 --> 00:14:35,879

really interesting i was i would i went

333

00:14:34,528 --> 00:14:37,678

to a plenary talk one of the funniest

334

00:14:35,879 --> 00:14:41,100

moments was i went to a plenary talk

335

00:14:37,678 --> 00:14:42,720

today where a guy was where the where an

336

00:14:41,100 --> 00:14:44,308

astronomer was trying to tell a whole

337

00:14:42,720 --> 00:14:46,410

lot a whole room full of astronomers

338

00:14:44,308 --> 00:14:48,298

about parallel universes and it was

339

00:14:46,409 --> 00:14:50,850

really very curious about that talk i

340

00:14:48,298 --> 00:14:52,860

didn't get to go see it so tell us about

341

00:14:50,850 --> 00:14:54,480

it it was the thing well I didn't

342

00:14:52,860 --> 00:14:56,519

understand it was the thing and I and I



343  
00:14:54,480 --> 00:14:58,019  
I got a sense that he was struggling a

344  
00:14:56,519 --> 00:15:01,078  
little bit himself parallel universes

345  
00:14:58,019 --> 00:15:05,278  
string theory all of this stuff is

346  
00:15:01,078 --> 00:15:06,988  
basically you have a theory that is it

347  
00:15:05,278 --> 00:15:10,919  
one of the one of the points in the talk

348  
00:15:06,989 --> 00:15:13,739  
was if X implies Y then y must be true

349  
00:15:10,919 --> 00:15:15,298  
and so if a theories that we note are

350  
00:15:13,739 --> 00:15:17,429  
true like quantum mechanics things like

351  
00:15:15,298 --> 00:15:19,379  
that imply something like string theory

352  
00:15:17,428 --> 00:15:21,208  
then string theory must be true and of

353  
00:15:19,379 --> 00:15:22,499  
course you know that's that's a line of

354  
00:15:21,208 --> 00:15:25,258  
thinking that you can argue with all you

355  
00:15:22,499 --> 00:15:26,249  
want but it's it was it was the point in

356  
00:15:25,259 --> 00:15:27,449  
the starting point of it and he was

357  
00:15:26,249 --> 00:15:29,129  
talking about what would parallel

358  
00:15:27,448 --> 00:15:30,808  
universes look like and how would we

359  
00:15:29,129 --> 00:15:32,938  
ever know and how many would there be I

360  
00:15:30,808 --> 00:15:35,278  
did not understand a word he said

361  
00:15:32,938 --> 00:15:36,748  
because that stuff always a string

362  
00:15:35,278 --> 00:15:38,789  
theory makes my head hurt every time

363  
00:15:36,749 --> 00:15:41,759  
someone tries to explain it to me I just

364  
00:15:38,789 --> 00:15:44,368  
don't understand it it makes me mad but

365  
00:15:41,759 --> 00:15:47,009  
anyway that was a talk I saw today the

366  
00:15:44,369 --> 00:15:49,048  
amusing part of it was his AV went its

367  
00:15:47,009 --> 00:15:50,519  
screen went wonky and so you can only

368  
00:15:49,048 --> 00:15:52,919  
see just a part of it and he was quite

369  
00:15:50,519 --> 00:15:54,209  
amusing and he was quite but he was

370  
00:15:52,919 --> 00:15:55,769  
quite entertaining with being able to

371

00:15:54,208 --> 00:15:57,028  
talk about in order to make people laugh

372  
00:15:55,769 --> 00:16:00,808  
about it and stuff it was it was a

373  
00:15:57,028 --> 00:16:02,668  
entertaining talk what about you well we

374  
00:16:00,808 --> 00:16:04,588  
talked we've talked a little bit in a

375  
00:16:02,668 --> 00:16:06,899  
previous hang out about a lot of the

376  
00:16:04,589 --> 00:16:08,819  
things that I went to see of course we

377  
00:16:06,899 --> 00:16:10,528  
had a lot of sessions as we do we have

378  
00:16:08,818 --> 00:16:12,509  
these individual sessions where people

379  
00:16:10,528 --> 00:16:15,418  
give ten minute talks on different

380  
00:16:12,509 --> 00:16:17,699  
topics there's a lot there were a few

381  
00:16:15,418 --> 00:16:20,559  
talks on exoplanets and debris disks but

382  
00:16:17,698 --> 00:16:23,229  
the the topics seem to move

383  
00:16:20,559 --> 00:16:26,500  
work towards the nearby universe and

384  
00:16:23,230 --> 00:16:28,930  
then distant universe is a lot of data

385  
00:16:26,500 --> 00:16:31,929

on how galaxies are formed how they

386

00:16:28,929 --> 00:16:33,969

interact how you measure them multi

387

00:16:31,929 --> 00:16:36,789

wavelengths not just helpful but many

388

00:16:33,970 --> 00:16:39,460

observatories the data put together and

389

00:16:36,789 --> 00:16:41,559

what we can learn and one of the

390

00:16:39,460 --> 00:16:44,050

questions is when you look back in time

391

00:16:41,559 --> 00:16:46,329

when did star formation start in

392

00:16:44,049 --> 00:16:49,359

galaxies and so there were a lot of

393

00:16:46,330 --> 00:16:51,250

those topics today did you go to that

394

00:16:49,360 --> 00:16:52,899

one on gravitational waves I did not get

395

00:16:51,250 --> 00:16:54,490

to go on gravitation because they still

396

00:16:52,899 --> 00:16:58,028

haven't found any right you haven't

397

00:16:54,490 --> 00:16:59,830

found any so the idea with the

398

00:16:58,028 --> 00:17:02,169

gravitational waves is you're looking

399

00:16:59,830 --> 00:17:04,299

for some phenomenon where there's a

400  
00:17:02,169 --> 00:17:06,789  
dramatic change in the gravity and this

401  
00:17:04,299 --> 00:17:09,129  
can be a collapse or something some

402  
00:17:06,789 --> 00:17:11,289  
catastrophic events where the gravity

403  
00:17:09,130 --> 00:17:13,870  
changes a lot and that the and that

404  
00:17:11,289 --> 00:17:18,519  
would be if it could be detected that

405  
00:17:13,869 --> 00:17:20,969  
would be in evidence that gravity works

406  
00:17:18,519 --> 00:17:26,679  
with waves and it's a very difficult

407  
00:17:20,970 --> 00:17:28,839  
experimental problem and all kinds of

408  
00:17:26,679 --> 00:17:31,690  
sophisticated instrumentation have been

409  
00:17:28,839 --> 00:17:33,819  
built and new techniques but as of yet

410  
00:17:31,690 --> 00:17:35,620  
there isn't really any definitive

411  
00:17:33,819 --> 00:17:37,480  
evidence of it that doesn't mean it

412  
00:17:35,619 --> 00:17:38,859  
doesn't exist it's just very very hard

413  
00:17:37,480 --> 00:17:41,110  
to observe and I think that kind of

414  
00:17:38,859 --> 00:17:44,619  
addresses your previous comment about

415  
00:17:41,109 --> 00:17:47,379  
multiverses is that it's fun to

416  
00:17:44,619 --> 00:17:48,909  
speculate about them but I think

417  
00:17:47,380 --> 00:17:50,950  
probably the bottom line at least we're

418  
00:17:48,910 --> 00:17:53,350  
an astronomer like me is what's the

419  
00:17:50,950 --> 00:17:55,240  
evidence and if we believe something

420  
00:17:53,349 --> 00:17:57,969  
exists and we have to find a way of

421  
00:17:55,240 --> 00:18:00,069  
getting data on it sometimes your

422  
00:17:57,970 --> 00:18:01,710  
experimental technique does not work out

423  
00:18:00,069 --> 00:18:04,509  
that you can detect it that doesn't

424  
00:18:01,710 --> 00:18:06,160  
eliminate the theory it just means you

425  
00:18:04,509 --> 00:18:10,599  
don't have the right instrumentation yet

426  
00:18:06,160 --> 00:18:12,670  
but it does draw one closer to the idea

427  
00:18:10,599 --> 00:18:14,859  
that maybe this thing that's being

428

00:18:12,670 --> 00:18:16,630  
proposed doesn't exist or it's not being

429  
00:18:14,859 --> 00:18:18,969  
proposed in the correct way so that's

430  
00:18:16,630 --> 00:18:20,740  
kind of how we think show me the data

431  
00:18:18,970 --> 00:18:21,149  
and a lot of my friends will tell you

432  
00:18:20,740 --> 00:18:22,739  
there

433  
00:18:21,148 --> 00:18:24,298  
tired of me saying that all the time but

434  
00:18:22,739 --> 00:18:25,829  
they'll say well what about this and

435  
00:18:24,298 --> 00:18:27,418  
what about that's i will say tell me

436  
00:18:25,829 --> 00:18:29,128  
that where the data is and what's the

437  
00:18:27,419 --> 00:18:30,989  
evidence for it and that's how

438  
00:18:29,128 --> 00:18:32,819  
astronomers think so i can understand

439  
00:18:30,989 --> 00:18:34,440  
how people would have had trouble with

440  
00:18:32,819 --> 00:18:36,088  
this talk especially if the view graph

441  
00:18:34,440 --> 00:18:38,009  
didn't work yeah and STIs yeah really

442  
00:18:36,088 --> 00:18:39,479

cuz its string theory well the thing but

443

00:18:38,009 --> 00:18:41,098

the thing about string theory that

444

00:18:39,479 --> 00:18:42,088

bothers me the most is it's you're right

445

00:18:41,098 --> 00:18:44,608

it's one of those things where the

446

00:18:42,088 --> 00:18:46,259

theory seems sound but there's

447

00:18:44,608 --> 00:18:47,968

absolutely no way you're talking about

448

00:18:46,259 --> 00:18:51,149

strings on order of the Planck length

449

00:18:47,969 --> 00:18:52,739

you can't it doesn't matter how good we

450

00:18:51,148 --> 00:18:55,018

get at building instruments it's an

451

00:18:52,739 --> 00:18:57,989

impossible length to measure it's simply

452

00:18:55,019 --> 00:18:59,819

bounded by the universe we live in so

453

00:18:57,989 --> 00:19:01,259

what's the point I don't I just I don't

454

00:18:59,819 --> 00:19:03,749

that's my biggest problem with string

455

00:19:01,259 --> 00:19:06,298

theory so for people who weren't with us

456

00:19:03,749 --> 00:19:08,009

before something else that happened



457  
00:19:06,298 --> 00:19:11,069  
which everybody always waits for is the

458  
00:19:08,009 --> 00:19:14,009  
NASA Town Hall NASA town hall is when

459  
00:19:11,069 --> 00:19:15,898  
nasa astrophysics which is part of the

460  
00:19:14,009 --> 00:19:17,700  
science Mission Directorate so science

461  
00:19:15,898 --> 00:19:19,168  
Mission Directorate in NASA there's

462  
00:19:17,700 --> 00:19:21,088  
administrator science Mission

463  
00:19:19,169 --> 00:19:23,429  
Directorate and then there's

464  
00:19:21,088 --> 00:19:25,918  
astrophysics earth science planetary and

465  
00:19:23,429 --> 00:19:28,259  
heliophysics the people who come and

466  
00:19:25,919 --> 00:19:31,259  
address the American Astronomical

467  
00:19:28,259 --> 00:19:34,679  
Society r is the head of astrophysics

468  
00:19:31,259 --> 00:19:37,079  
and so he he gave his view of how we can

469  
00:19:34,679 --> 00:19:39,479  
prepare in the next five years for the

470  
00:19:37,079 --> 00:19:42,509  
decadal report and what he is looking

471  
00:19:39,479 --> 00:19:46,259  
for and so it's it's this tension

472  
00:19:42,509 --> 00:19:49,079  
between this community saying what we'd

473  
00:19:46,259 --> 00:19:51,419  
really like to study is this but we have

474  
00:19:49,079 --> 00:19:54,058  
to face the reality of the budget and

475  
00:19:51,419 --> 00:19:56,009  
understand that Congress and the

476  
00:19:54,058 --> 00:19:57,329  
American people through taxpayer dollars

477  
00:19:56,009 --> 00:20:00,389  
are only going to support a certain

478  
00:19:57,329 --> 00:20:03,898  
amount reminding everybody that the NASA

479  
00:20:00,388 --> 00:20:05,878  
budget is a fraction on the dollar not

480  
00:20:03,898 --> 00:20:08,338  
even a penny on the dollar and the

481  
00:20:05,878 --> 00:20:13,558  
science budget of that is even smaller

482  
00:20:08,338 --> 00:20:15,690  
so it's nothing like DoD or welfare or

483  
00:20:13,558 --> 00:20:19,319  
anything like that it's a tiny tiny

484  
00:20:15,690 --> 00:20:21,239  
amount of our gross national product for

485

00:20:19,319 --> 00:20:23,788  
the United States but still we have to

486  
00:20:21,239 --> 00:20:25,558  
spend it carefully and so we can wax

487  
00:20:23,788 --> 00:20:28,048  
eloquent about all the things we want to

488  
00:20:25,558 --> 00:20:29,848  
study but then you have to come back to

489  
00:20:28,048 --> 00:20:30,558  
the reality what kind of money do we

490  
00:20:29,848 --> 00:20:33,019  
have and

491  
00:20:30,558 --> 00:20:36,138  
can we we need to responsibly spend it

492  
00:20:33,019 --> 00:20:38,778  
and so the head of astrophysics gave us

493  
00:20:36,138 --> 00:20:41,569  
his view about the things he sees

494  
00:20:38,778 --> 00:20:44,628  
emerging in the community the big-ticket

495  
00:20:41,569 --> 00:20:46,638  
items not prescribing our science but

496  
00:20:44,628 --> 00:20:50,148  
just saying this is what it looks like

497  
00:20:46,638 --> 00:20:51,619  
to me so if that's what it is tell me

498  
00:20:50,148 --> 00:20:53,298  
what kind of missions you need and all

499  
00:20:51,619 --> 00:20:55,069

the technology you need and if that's

500

00:20:53,298 --> 00:20:57,679

not what it is and you need to add

501

00:20:55,069 --> 00:20:59,509

another box tell me what that boxes and

502

00:20:57,679 --> 00:21:01,309

and what kind of technology do you need

503

00:20:59,509 --> 00:21:03,740

there so that's kind of how we do this

504

00:21:01,308 --> 00:21:07,819

and every year we get an update with him

505

00:21:03,740 --> 00:21:10,490

have a discussion and and try to do more

506

00:21:07,819 --> 00:21:12,648

studies and make preparation for the

507

00:21:10,490 --> 00:21:15,589

decade report which will happen around

508

00:21:12,648 --> 00:21:16,908

20 19 20 20 right and another but

509

00:21:15,589 --> 00:21:18,019

another thing he did yeah and another

510

00:21:16,909 --> 00:21:19,490

thing he did was it gave us a status

511

00:21:18,019 --> 00:21:20,509

report on some of the missions and how

512

00:21:19,490 --> 00:21:22,609

they're doing now and how they're being

513

00:21:20,509 --> 00:21:24,798

funded one of the things I was very

514  
00:21:22,609 --> 00:21:27,288  
gratified to see was you know W first

515  
00:21:24,798 --> 00:21:29,778  
was the top priority of the last decade

516  
00:21:27,288 --> 00:21:31,038  
o survey and that the funding and

517  
00:21:29,778 --> 00:21:33,259  
starting on that now and looks like

518  
00:21:31,038 --> 00:21:34,278  
progress is being made in 2015 what

519  
00:21:33,259 --> 00:21:36,589  
they're going to be built is starting

520  
00:21:34,278 --> 00:21:39,288  
the what it's called the technology

521  
00:21:36,589 --> 00:21:40,638  
development phase of what Mark postman

522  
00:21:39,288 --> 00:21:43,099  
was saying this morning is a lot of

523  
00:21:40,638 --> 00:21:45,019  
stuff still needs to be developed and

524  
00:21:43,099 --> 00:21:46,998  
built and even invented much like with

525  
00:21:45,019 --> 00:21:49,009  
James Webb so that I guess has finally

526  
00:21:46,999 --> 00:21:51,649  
started this year right study of what

527  
00:21:49,009 --> 00:21:54,710  
technology you think maybe doesn't exist

528  
00:21:51,648 --> 00:21:56,658  
but might be possible and that so you do

529  
00:21:54,710 --> 00:21:59,298  
the study and then you say okay this is

530  
00:21:56,659 --> 00:22:00,740  
a technology we think that in you know

531  
00:21:59,298 --> 00:22:03,528  
five to ten years we can actually

532  
00:22:00,740 --> 00:22:05,419  
develop it's kind of like you know

533  
00:22:03,528 --> 00:22:07,220  
making new cars where you say okay in

534  
00:22:05,419 --> 00:22:09,288  
five years we think the car will be

535  
00:22:07,220 --> 00:22:12,379  
autonomous and we think we can do that

536  
00:22:09,288 --> 00:22:15,109  
or no we can't sew sew matching the

537  
00:22:12,378 --> 00:22:17,028  
science studying what's needed studying

538  
00:22:15,109 --> 00:22:19,248  
the technology and then saying whether

539  
00:22:17,028 --> 00:22:21,710  
it's realistic or not and then can we

540  
00:22:19,249 --> 00:22:23,089  
afford it so it's a long process yeah so

541  
00:22:21,710 --> 00:22:25,460  
it's very it's always a well-attended

542

00:22:23,089 --> 00:22:26,990  
event and tomorrow there's going to be

543  
00:22:25,460 --> 00:22:29,240  
one on the Hubble Space Telescope Space

544  
00:22:26,990 --> 00:22:32,388  
Telescope will have a town hall around

545  
00:22:29,240 --> 00:22:33,740  
lunchtime and we'll talk about how us a

546  
00:22:32,388 --> 00:22:35,928  
little bit about what we talked about

547  
00:22:33,740 --> 00:22:37,450  
today as well what is Hubble going to be

548  
00:22:35,929 --> 00:22:40,369  
like in the next five to ten years

549  
00:22:37,450 --> 00:22:42,289  
what's its role in our community and

550  
00:22:40,368 --> 00:22:44,089  
then we're going to have some update

551  
00:22:42,289 --> 00:22:46,579  
it's on the frontier fields and a couple

552  
00:22:44,089 --> 00:22:48,379  
other topics yeah I can't ken and jen

553  
00:22:46,579 --> 00:22:50,629  
and various other people are going to be

554  
00:22:48,380 --> 00:22:52,010  
talking at that one so anniversary

555  
00:22:50,630 --> 00:22:53,900  
celebration that's right we're going to

556  
00:22:52,009 --> 00:22:55,579

have some talking about that and we'll

557

00:22:53,900 --> 00:22:58,130

have a guest from NASA headquarters

558

00:22:55,579 --> 00:23:00,439

tomorrow who will talk about 25th

559

00:22:58,130 --> 00:23:04,220

anniversary celebrations on our hangout

560

00:23:00,440 --> 00:23:06,320

okay so that's pretty anything else that

561

00:23:04,220 --> 00:23:07,970

we can think of about today we did our

562

00:23:06,319 --> 00:23:09,049

hangouts earlier today a lot of good lot

563

00:23:07,970 --> 00:23:10,850

of good stuff coming out of the meeting

564

00:23:09,049 --> 00:23:13,159

we're trying to cover as much of it as

565

00:23:10,849 --> 00:23:14,359

we can but it's just too much well you

566

00:23:13,160 --> 00:23:17,120

know we get the stuff that we find the

567

00:23:14,359 --> 00:23:19,309

most interesting so so that I guess

568

00:23:17,119 --> 00:23:21,169

we'll stop for this one anything else

569

00:23:19,309 --> 00:23:23,659

you wanna add Carol yep okay so all

570

00:23:21,170 --> 00:23:26,990

right so so tomorrow we've got for



571  
00:23:23,660 --> 00:23:28,640  
hangouts coming up 1030 over at the

572  
00:23:26,990 --> 00:23:30,289  
Northrop Grumman booth I will be will

573  
00:23:28,640 --> 00:23:31,820  
have meguri the president of the

574  
00:23:30,289 --> 00:23:35,210  
American Astronomical Society talking

575  
00:23:31,819 --> 00:23:36,889  
about industry and astronomy and how

576  
00:23:35,210 --> 00:23:38,690  
they can interact that'll be over at

577  
00:23:36,890 --> 00:23:40,490  
Northrop Grumman at one o'clock also at

578  
00:23:38,690 --> 00:23:41,450  
North overwhelm it might be here or the

579  
00:23:40,490 --> 00:23:44,059  
North akroma booth I can remember

580  
00:23:41,450 --> 00:23:46,299  
Alberto and and colleague of his we're

581  
00:23:44,059 --> 00:23:50,210  
going to be talking about exoplanets at

582  
00:23:46,299 --> 00:23:52,430  
three-thirty we have our hangout on the

583  
00:23:50,210 --> 00:23:54,019  
Hubble 25th of celebration kickoff which

584  
00:23:52,430 --> 00:23:55,580  
is basically we're kind of considering

585  
00:23:54,019 --> 00:23:57,349  
this week sort of the kickoff right and

586  
00:23:55,579 --> 00:23:59,480  
then we'll do a follow-up and then that

587  
00:23:57,349 --> 00:24:03,199  
will be it from this meeting and we will

588  
00:23:59,480 --> 00:24:05,390  
be done are you holding up are you

589  
00:24:03,200 --> 00:24:07,160  
entire Duncan tired these are very long

590  
00:24:05,390 --> 00:24:09,410  
day this is one of the most intense

591  
00:24:07,160 --> 00:24:11,690  
meetings that I've been too because

592  
00:24:09,410 --> 00:24:14,120  
meant very often they started 830 in the

593  
00:24:11,690 --> 00:24:17,180  
morning they go to around six and then

594  
00:24:14,119 --> 00:24:19,429  
the exhibit hall closes but this meeting

595  
00:24:17,180 --> 00:24:21,140  
we've had many many many many meetings

596  
00:24:19,430 --> 00:24:25,220  
all the way up until nine o'clock no

597  
00:24:21,140 --> 00:24:27,740  
like 12 hours every day yes and I've

598  
00:24:25,220 --> 00:24:29,720  
actually yeah and I've actually recorded

599

00:24:27,740 --> 00:24:31,759  
some of them there was the UV Ori

600  
00:24:29,720 --> 00:24:34,430  
session that was on monday i recorded it

601  
00:24:31,759 --> 00:24:37,039  
i also recorded the JWST Town Hall last

602  
00:24:34,430 --> 00:24:39,289  
night and I'll record the HST Town Hall

603  
00:24:37,039 --> 00:24:41,990  
tomorrow they won't let me live stream

604  
00:24:39,289 --> 00:24:43,670  
those here but i am recording them and

605  
00:24:41,990 --> 00:24:44,870  
they will be posted to our hubble site

606  
00:24:43,670 --> 00:24:47,150  
channel youtube channel so if you

607  
00:24:44,869 --> 00:24:48,469  
haven't subscribed hubble site yet you

608  
00:24:47,150 --> 00:24:49,970  
need to this is how you find that's the

609  
00:24:48,470 --> 00:24:51,890  
best way to find out about the hangouts

610  
00:24:49,970 --> 00:24:54,980  
that we've got coming also follow us on

611  
00:24:51,890 --> 00:24:56,060  
twitter hubble telescope as well as g

612  
00:24:54,980 --> 00:24:58,490  
plus we're also

613  
00:24:56,059 --> 00:25:00,679

Hubble Space Telescope so all right

614

00:24:58,490 --> 00:25:03,460

that's it that's it thank you all for

615

00:25:00,680 --> 00:25:03,460

watching we'll see you guys