
IRRADIATED BROWN DWARFS
SARAH CASEWELL

1
00:00:09,720 --> 00:00:07,560
[Music]

2
00:00:11,490 --> 00:00:09,730
and I'm gonna start talking to you a

3
00:00:14,280 --> 00:00:11,500
little bit about irradiated brown dwarfs

4
00:00:17,310 --> 00:00:14,290
with my favorite quote about them which

5
00:00:19,020 --> 00:00:17,320
is actually useful which is from Adam

6
00:00:20,910 --> 00:00:19,030
Sherman and told us they are ready to

7
00:00:22,650 --> 00:00:20,920
brown dwarfs filled as crucial fourth

8
00:00:25,650 --> 00:00:22,660
corner extra matter space between

9
00:00:27,720 --> 00:00:25,660
isolated brown dwarfs who are down here

10
00:00:30,810 --> 00:00:27,730
at the bottom with high interior heat

11
00:00:32,940 --> 00:00:30,820
flux and low external irradiation

12
00:00:36,300 --> 00:00:32,950
irradiated exoplanets who are the

13
00:00:40,110 --> 00:00:36,310

reverse even low interior heat high

14
00:00:41,760 --> 00:00:40,120
external heat solar system planets here

15
00:00:44,459 --> 00:00:41,770
at the bottom with low interior and

16
00:00:48,330 --> 00:00:44,469
external heat and my relative and will

17
00:00:50,760 --> 00:00:48,340
sit up here so they sort of fit nicely

18
00:00:53,490 --> 00:00:50,770
within the zoom of planets and brown

19
00:00:54,900 --> 00:00:53,500
dwarfs and give us some idea of how we

20
00:00:59,150 --> 00:00:54,910
can look at all of them and how they all

21
00:01:01,380 --> 00:00:59,160
fits together now the problem with a

22
00:01:03,060 --> 00:01:01,390
radiative brown dwarfs in general is

23
00:01:06,060 --> 00:01:03,070
that there are not many of them known

24
00:01:08,430 --> 00:01:06,070
due to the brown dwarf desert though

25
00:01:10,770 --> 00:01:08,440
brown dwarfs in closed orbits are our

26
00:01:15,179 --> 00:01:10,780
main sequence stars there are about 19

27
00:01:17,399 --> 00:01:15,189
or 20 known today and irritatingly they

28
00:01:19,950 --> 00:01:17,409
have more problems than observing hot

29
00:01:22,800 --> 00:01:19,960
Jupiters because they have higher masses

30
00:01:24,569 --> 00:01:22,810
higher gravities lower scale height so

31
00:01:26,219 --> 00:01:24,579
you can perform transmission

32
00:01:29,370 --> 00:01:26,229
spectroscopy on them which is a little

33
00:01:31,620 --> 00:01:29,380
bit annoying what we can do however is

34
00:01:34,080 --> 00:01:31,630
observe these systems in their evolved

35
00:01:36,980 --> 00:01:34,090
forms so we take the main sequence star

36
00:01:40,469 --> 00:01:36,990
and we let it evolves it becomes a giant

37
00:01:42,539 --> 00:01:40,479
the envelope encompasses the brown dwarf

38
00:01:44,399 --> 00:01:42,549

which begins to spiral in and provided

39
00:01:47,069 --> 00:01:44,409
it doesn't die a horrible fiery death on

40
00:01:48,870 --> 00:01:47,079
the current star we're left with once

41
00:01:51,179 --> 00:01:48,880
the envelopes been rejected a white

42
00:01:53,190 --> 00:01:51,189
dwarf brown dwarf system so the brown

43
00:01:56,990 --> 00:01:53,200
dwarf obits the white dwarf with a

44
00:01:58,920 --> 00:01:57,000
period of a few hours down to the lowest

45
00:02:02,249 --> 00:01:58,930
periods we have about sixty eight

46
00:02:04,800 --> 00:02:02,259
minutes and there are nine or ten of

47
00:02:07,649 --> 00:02:04,810
these nouns so fewer than R and also a

48
00:02:10,080 --> 00:02:07,659
main sequence stars but because they all

49
00:02:11,850 --> 00:02:10,090
be a white dwarf we have the massive

50
00:02:15,300 --> 00:02:11,860
benefit that we can actually directly

51
00:02:17,550 --> 00:02:15,310
observe them so white dwarfs as you all

52
00:02:19,650 --> 00:02:17,560
know are small they're earth sized and

53
00:02:21,030 --> 00:02:19,660
they primarily emit in the UV and the

54
00:02:23,670 --> 00:02:21,040
optical

55
00:02:28,259 --> 00:02:23,680
and when we get to the infrared you can

56
00:02:30,390 --> 00:02:28,269
begin to see an infra rex s is due to

57
00:02:33,929 --> 00:02:30,400
the brown dwarf so this is a Gina

58
00:02:36,000 --> 00:02:33,939
spectrum of an odd yet unpublished

59
00:02:38,009 --> 00:02:36,010
system which is appears to be an l5

60
00:02:40,319 --> 00:02:38,019
brown dwarf orbiting at 10,000 Kelvin

61
00:02:43,649 --> 00:02:40,329
white dwarf compared to about two hours

62
00:02:45,660 --> 00:02:43,659
and the nice thing about these is we can

63
00:02:48,449 --> 00:02:45,670

subtract the white dwarf spectra off

64
00:02:50,849 --> 00:02:48,459
white dwarfs conversely to brown dwarfs

65
00:02:53,460 --> 00:02:50,859
and exoplanets are relatively simple to

66
00:02:55,949 --> 00:02:53,470
model and we can subtract wiped off

67
00:02:58,410 --> 00:02:55,959
models and get left with the brown dwarf

68
00:03:00,300 --> 00:02:58,420
spectrum and then we can analyze an

69
00:03:03,180 --> 00:03:00,310
isolated brown dwarf so look at gravity

70
00:03:06,629 --> 00:03:03,190
sensitive indices look at other

71
00:03:09,599 --> 00:03:06,639
indicators or gravity metallicity

72
00:03:12,479 --> 00:03:09,609
exactly try and determine if the brand

73
00:03:15,990 --> 00:03:12,489
off is inflated due to the heat from the

74
00:03:17,970 --> 00:03:16,000
white dwarf well we can also do with

75
00:03:19,949 --> 00:03:17,980
spectra is we can try and determine

76
00:03:22,319 --> 00:03:19,959
what's going on there and off atmosphere

77
00:03:24,690 --> 00:03:22,329
due to emission lines so if the brown

78
00:03:26,400 --> 00:03:24,700
dwarf is significantly heated and we

79
00:03:29,430 --> 00:03:26,410
have about three or four of these that

80
00:03:32,490 --> 00:03:29,440
are at the moment then we get HL 4

81
00:03:37,140 --> 00:03:32,500
emission so in this case is your dark

82
00:03:38,729 --> 00:03:37,150
line is the trail of the hydrogen line

83
00:03:42,000 --> 00:03:38,739
this is the a child for absorption

84
00:03:43,979 --> 00:03:42,010
feature and this crazy line here is your

85
00:03:45,900 --> 00:03:43,989
HL 4 emission feature this is the night

86
00:03:48,449 --> 00:03:45,910
side of burned wall and this is the day

87
00:03:51,420 --> 00:03:48,459
side of the mantle you can see we have

88
00:03:53,670 --> 00:03:51,430

two or three where this is possible to

89
00:03:56,009 --> 00:03:53,680
determine so WD lon 3/7 is the best

90
00:03:59,930 --> 00:03:56,019
known of these systems it's 114 minute

91
00:04:02,490 --> 00:03:59,940
period and it's a brown dwarf orbiting a

92
00:04:02,879 --> 00:04:02,500
the katene a half thousand Kelvin white

93
00:04:05,009 --> 00:04:02,889
dwarf

94
00:04:08,000 --> 00:04:05,019
these two are in 70ish minute orbits

95
00:04:10,199 --> 00:04:08,010
around 25,000 kelvin white dwarfs

96
00:04:11,809 --> 00:04:10,209
certainly they're moving exactly fast

97
00:04:14,839 --> 00:04:11,819
around something that's very very hot

98
00:04:17,759 --> 00:04:14,849
and as you might expect if we look at

99
00:04:19,890 --> 00:04:17,769
the rest of the spectra if we have it

100
00:04:23,580 --> 00:04:19,900
then we get all sorts of other emission

101
00:04:25,230 --> 00:04:23,590
lines now the thing i think is

102
00:04:28,740 --> 00:04:25,240
particularly interesting about this is

103
00:04:29,969 --> 00:04:28,750
when we came to look at other emission

104
00:04:33,450 --> 00:04:29,979
lines and trying to determine what's

105
00:04:35,760 --> 00:04:33,460
going on in the Brandel atmosphere

106
00:04:37,680 --> 00:04:35,770
it became quite clear that we were not

107
00:04:40,470 --> 00:04:37,690
getting the same emission features from

108
00:04:42,270 --> 00:04:40,480
all the brown dwarfs and it was not the

109
00:04:43,760 --> 00:04:42,280
most irradiated brown dwarf that was

110
00:04:46,350 --> 00:04:43,770
giving us the most emission features

111
00:04:49,020 --> 00:04:46,360
which came as a little bit of a surprise

112
00:04:51,120 --> 00:04:49,030
to me though WD 137

113
00:04:55,650 --> 00:04:51,130

well known object has all of these

114
00:04:57,420 --> 00:04:55,660
species in it this is an LA to office at

115
00:05:00,840 --> 00:04:57,430
the end of the alta T transition

116
00:05:04,220 --> 00:05:00,850
sequence white dwarf 16 1/2 thousand

117
00:05:07,800 --> 00:05:04,230
Kelvin thousand 14 minute period this

118
00:05:09,630 --> 00:05:07,810
object with the crazy name only has

119
00:05:11,160 --> 00:05:09,640
these emission features but both sets of

120
00:05:13,410 --> 00:05:11,170
actuator spectral we're not missing any

121
00:05:15,990 --> 00:05:13,420
sort of emission features here due to

122
00:05:17,820 --> 00:05:16,000
wavelength coverage it's orbiting a much

123
00:05:21,570 --> 00:05:17,830
hotter white dwarf in a much shorter

124
00:05:23,070 --> 00:05:21,580
period we see much less stuff the main

125
00:05:27,090 --> 00:05:23,080
difference is the spectral type of the

126
00:05:29,220 --> 00:05:27,100
brand wars so in an epoch in telephone

127
00:05:32,850 --> 00:05:29,230
number here it's an l-3 dwarf it's much

128
00:05:36,930 --> 00:05:32,860
more cloudy than the l8 where the clouds

129
00:05:38,820 --> 00:05:36,940
have started to disperse in some way so

130
00:05:43,130 --> 00:05:38,830
this I found quite interesting those you

131
00:05:47,460 --> 00:05:43,140
who study clouds may not found that as

132
00:05:50,430 --> 00:05:47,470
sort of knew as I did but we then found

133
00:05:52,230 --> 00:05:50,440
that of the tan white dwarf and albino

134
00:05:55,620 --> 00:05:52,240
is known there are only three there are

135
00:05:57,270 --> 00:05:55,630
eclipsing and this guy was the options

136
00:05:59,160 --> 00:05:57,280
particularly infrared to actually

137
00:05:59,940 --> 00:05:59,170
directly detect the dark side of the

138
00:06:03,360 --> 00:05:59,950

brown dwarf

139
00:06:06,300 --> 00:06:03,370
these things tightly not and there are

140
00:06:09,720 --> 00:06:06,310
about xx ish magnitude in the HM the

141
00:06:11,550 --> 00:06:09,730
cave and so they are detectable compared

142
00:06:14,370 --> 00:06:11,560
to extra points where this Germany isn't

143
00:06:17,820 --> 00:06:14,380
the case and I apologize for the

144
00:06:19,590 --> 00:06:17,830
slightly ratty data our Hawkeye time was

145
00:06:22,110 --> 00:06:19,600
not taking as good as conditions we'd

146
00:06:24,510 --> 00:06:22,120
like but what we ended up with

147
00:06:26,070 --> 00:06:24,520
essentially our brightness temperatures

148
00:06:27,930 --> 00:06:26,080
based on the night side these are the

149
00:06:30,300 --> 00:06:27,940
maximum the minimum day and night side

150
00:06:31,500 --> 00:06:30,310
temperatures the average day night so

151
00:06:35,460 --> 00:06:31,510
temperatures have a difference of about

152
00:06:36,600 --> 00:06:35,470
100 Kelvin for this object however when

153
00:06:38,760 --> 00:06:36,610
we compare that to you

154
00:06:41,870 --> 00:06:38,770
effective temperatures for the day in

155
00:06:44,370 --> 00:06:41,880
the night side we come out with sort of

156
00:06:46,170 --> 00:06:44,380
temperatures of about thirty thousand

157
00:06:50,180 --> 00:06:46,180
fourteen thousand Kelvin

158
00:06:52,560 --> 00:06:50,190
now the subject in particular CSS 1411

159
00:06:55,410 --> 00:06:52,570
should be the brown dwarf should be a

160
00:06:57,420 --> 00:06:55,420
tea Dorf we have good masses from where

161
00:06:59,610 --> 00:06:57,430
your velocity z' we have eclipses that

162
00:07:01,200 --> 00:06:59,620
we know it's radius it's not

163
00:07:04,560 --> 00:07:01,210

particularly young there's nothing

164
00:07:06,120 --> 00:07:04,570
particularly weird about it and it

165
00:07:09,510 --> 00:07:06,130
should have an effective temperature of

166
00:07:11,160 --> 00:07:09,520
about 800 Kelvin now looking at our

167
00:07:14,100 --> 00:07:11,170
light curve modeling and all the other

168
00:07:17,100 --> 00:07:14,110
information we've got there's no way we

169
00:07:19,740 --> 00:07:17,110
can bump that temperature up to 1300

170
00:07:22,800 --> 00:07:19,750
Kelvin by simply pouring in here on the

171
00:07:24,510 --> 00:07:22,810
day side I like have models as I'm sure

172
00:07:26,310 --> 00:07:24,520
most of your like live models have since

173
00:07:27,660 --> 00:07:26,320
of absorb parameter that deals with the

174
00:07:30,060 --> 00:07:27,670
amount of flux that comes in and whether

175
00:07:33,750 --> 00:07:30,070
it gets me irradiated or circulates

176
00:07:36,900 --> 00:07:33,760
around the object and this is our 8090

177
00:07:38,550 --> 00:07:36,910
percent CG in the cab and so we

178
00:07:40,860 --> 00:07:38,560
physically can't stick anymore he don't

179
00:07:43,050 --> 00:07:40,870
suspend or heat it up to this

180
00:07:46,380 --> 00:07:43,060
temperature so we were left wondering

181
00:07:49,230 --> 00:07:46,390
what on earth might be going on and our

182
00:07:51,300 --> 00:07:49,240
suggestion was perhaps that what we see

183
00:07:52,980 --> 00:07:51,310
is effectively a said nicely temperature

184
00:07:55,710 --> 00:07:52,990
isn't a temperature it's that we have an

185
00:07:59,070 --> 00:07:55,720
artificial flux sort of boosting if you

186
00:08:00,810 --> 00:07:59,080
like due to the UVA radiation from the

187
00:08:02,760 --> 00:08:00,820
white dwarf so we've got some sort of

188
00:08:04,530 --> 00:08:02,770

photochemistry going on here whether

189
00:08:07,110 --> 00:08:04,540
it's something like

190
00:08:08,400 --> 00:08:07,120
hc+ whether it's HT for essence maybe

191
00:08:11,490 --> 00:08:08,410
it's something we haven't heard of we're

192
00:08:14,130 --> 00:08:11,500
not sure but we think this might be

193
00:08:16,200 --> 00:08:14,140
happening frustratingly this object is

194
00:08:17,550 --> 00:08:16,210
towards the faint end of what we can do

195
00:08:19,410 --> 00:08:17,560
is they're getting spectra of it and

196
00:08:21,270 --> 00:08:19,420
they in the infrared isn't really

197
00:08:24,980 --> 00:08:21,280
possible at 19th Agnes you this is

198
00:08:28,910 --> 00:08:24,990
difficult for us it's a James Webb wait

199
00:08:31,680 --> 00:08:28,920
but the results we get are similar to

200
00:08:34,830 --> 00:08:31,690
what we got for W do 1 through 7 so this

201
00:08:36,840 --> 00:08:34,840
isn't eclipsing but we have extremely

202
00:08:39,020 --> 00:08:36,850
good light curves in about five wave

203
00:08:41,850 --> 00:08:39,030
fans and we can subtract the white dwarf

204
00:08:44,160 --> 00:08:41,860
contribution my gloss don't vary in

205
00:08:46,440 --> 00:08:44,170
general so we can subtract the white

206
00:08:48,540 --> 00:08:46,450
dwarf contribution and calculate the day

207
00:08:51,770 --> 00:08:48,550
of the night side temperature from the

208
00:08:55,260 --> 00:08:51,780
reflection effect that we see and using

209
00:08:58,170 --> 00:08:55,270
Jonathan for tonie's models here for a

210
00:08:59,430 --> 00:08:58,180
radiative brown dwarfs we found our best

211
00:08:59,860 --> 00:08:59,440
fitting model is the black line at the

212
00:09:01,660 --> 00:08:59,870
bottom

213
00:09:03,670 --> 00:09:01,670

to the dayside points which are these

214
00:09:05,790 --> 00:09:03,680
solid points the Nightside points of the

215
00:09:10,690 --> 00:09:05,800
big squares down at the bottom here and

216
00:09:12,820 --> 00:09:10,700
the model fit quite well to the data the

217
00:09:16,480 --> 00:09:12,830
model has circulation all the way around

218
00:09:17,620 --> 00:09:16,490
the brown dwarf and it didn't have a IO

219
00:09:20,740 --> 00:09:17,630
in it which was something we were

220
00:09:21,940 --> 00:09:20,750
looking at at the time however you can

221
00:09:23,170 --> 00:09:21,950
see these two points here this at the

222
00:09:27,280 --> 00:09:23,180
cabe and this it's four point five

223
00:09:29,140 --> 00:09:27,290
micron again these are the points here

224
00:09:32,110 --> 00:09:29,150
are too bright compared to what they

225
00:09:33,550 --> 00:09:32,120
should be for the model and again if you

226
00:09:35,560 --> 00:09:33,560
were going to look for something like HD

227
00:09:38,470 --> 00:09:35,570
plus or a steeped resonance these are

228
00:09:43,300 --> 00:09:38,480
the way fans where you would expect to

229
00:09:47,050 --> 00:09:43,310
see it so again we're left with the

230
00:09:50,500 --> 00:09:47,060
suggestion that the UV from the white

231
00:09:54,030 --> 00:09:50,510
dwarf is causing some sort of glow or

232
00:09:57,250 --> 00:09:54,040
boosting within these wave mounts and

233
00:09:58,240 --> 00:09:57,260
this is this is my great question at the

234
00:10:00,700 --> 00:09:58,250
moment and unfortunately I'm left

235
00:10:02,770 --> 00:10:00,710
waiting for spectra four point five

236
00:10:04,390 --> 00:10:02,780
microns which is James Webb and so we

237
00:10:09,010 --> 00:10:04,400
can actually try and determine what's

238
00:10:11,200 --> 00:10:09,020

going on here okay so that's sort of my

239
00:10:13,030 --> 00:10:11,210
my plug for irradiated brown dwarfs of

240
00:10:17,650 --> 00:10:13,040
why they're interesting how do they fit

241
00:10:22,060 --> 00:10:17,660
in with exoplanets so this is a figure I

242
00:10:23,830 --> 00:10:22,070
have reproduced from the work of Comet

243
00:10:28,270 --> 00:10:23,840
check at AU and I apologize if I've

244
00:10:31,960 --> 00:10:28,280
mispronounced your name there so these

245
00:10:33,820 --> 00:10:31,970
are a bunch of no exoplanets with

246
00:10:36,580 --> 00:10:33,830
equilibrium temperature versus this

247
00:10:38,200 --> 00:10:36,590
eight absorbed parameter which is the

248
00:10:40,180 --> 00:10:38,210
black assumption the day- the ninth

249
00:10:43,270 --> 00:10:40,190
divided by the de daytime practice

250
00:10:46,330 --> 00:10:43,280
temperature and you can see that

251
00:10:49,390 --> 00:10:46,340
actually has 14 11 the eclipsing system

252
00:10:51,510 --> 00:10:49,400
it's quite nicely down here almost on a

253
00:10:56,920 --> 00:10:51,520
nice straight line with everything else

254
00:10:59,590 --> 00:10:56,930
W do 137 is sort of almost on a line

255
00:11:02,170 --> 00:10:59,600
below somewhere hanging out with happy

256
00:11:06,760 --> 00:11:02,180
70 which is everybody's other favourite

257
00:11:08,710 --> 00:11:06,770
weirdo X upon M so I I've shown this

258
00:11:10,930 --> 00:11:08,720
because I think it's interesting to show

259
00:11:12,670 --> 00:11:10,940
you that these brown dwarfs are not that

260
00:11:13,010 --> 00:11:12,680
different from extra finance despite the

261
00:11:14,530 --> 00:11:13,020
fact

262
00:11:19,580 --> 00:11:14,540
that they have higher masses and

263
00:11:21,950 --> 00:11:19,590

slightly different radii I'm curious if

264
00:11:23,960 --> 00:11:21,960
you have exchanges when we have better

265
00:11:26,300 --> 00:11:23,970
data smaller error balls and more points

266
00:11:29,540 --> 00:11:26,310
on here I'm and hopefully more brown

267
00:11:31,280 --> 00:11:29,550
dwarfs on here as well thank you

268
00:11:33,110 --> 00:11:31,290
okay so I'm going to finish up talking

269
00:11:37,510 --> 00:11:33,120
about the mass radius relation for these

270
00:11:40,280 --> 00:11:37,520
objects so this is the irradiated mass

271
00:11:44,180 --> 00:11:40,290
radius relationship radio - brown dwarf

272
00:11:46,040 --> 00:11:44,190
mass radius relationship so mass on the

273
00:11:48,350 --> 00:11:46,050
bottom Brown will raise on the side and

274
00:11:50,000 --> 00:11:48,360
these are all the known irradiated brown

275
00:11:52,460 --> 00:11:50,010
dwarfs around main sequence stars and

276
00:11:55,520 --> 00:11:52,470
the two where we have actual measured

277
00:11:58,040 --> 00:11:55,530
radii around white dwarfs so the two

278
00:12:00,830 --> 00:11:58,050
white dwarf ones are here interestingly

279
00:12:03,110 --> 00:12:00,840
enough they sit within the so-called

280
00:12:05,930 --> 00:12:03,120
mass gap for these brown dwarfs around

281
00:12:08,290 --> 00:12:05,940
the main sequence stars and in fact most

282
00:12:14,140 --> 00:12:08,300
of the brown dwarfs around white dwarfs

283
00:12:18,920 --> 00:12:16,850
this perhaps isn't massively surprising

284
00:12:21,380 --> 00:12:18,930
because if we're looking for them we're

285
00:12:25,010 --> 00:12:21,390
looking for brand offs around white

286
00:12:26,600 --> 00:12:25,020
dwarfs in general then if they are

287
00:12:28,070 --> 00:12:26,610
brighter in the infrared

288
00:12:29,390 --> 00:12:28,080

they are easier for us to see which

289
00:12:33,410 --> 00:12:29,400
tends to mean there's a higher mass

290
00:12:35,930 --> 00:12:33,420
earlier special type objects okay so the

291
00:12:37,460 --> 00:12:35,940
other thing that's quite interesting to

292
00:12:40,520 --> 00:12:37,470
look at this so we've got these are the

293
00:12:44,180 --> 00:12:40,530
model it's about barracks models so 100

294
00:12:46,520 --> 00:12:44,190
million years one big year five years

295
00:12:48,950 --> 00:12:46,530
and ten good years at the bottom and

296
00:12:50,630 --> 00:12:48,960
brown dwarfs all tend to about the same

297
00:12:54,140 --> 00:12:50,640
radius as they age they cool as they

298
00:12:56,540 --> 00:12:54,150
also generate objects so these objects

299
00:12:58,250 --> 00:12:56,550
would be what a brand will person would

300
00:13:01,430 --> 00:12:58,260
sort of refer to as having feel to

301
00:13:03,470 --> 00:13:01,440
gravity in general none of the stars

302
00:13:05,300 --> 00:13:03,480
these plants are around are regarded as

303
00:13:08,180 --> 00:13:05,310
young because it me not 100 million

304
00:13:10,490 --> 00:13:08,190
years old so these are the inflated

305
00:13:13,220 --> 00:13:10,500
objects I believe that one there is Cal

306
00:13:15,950 --> 00:13:13,230
plumby and pretty much everything else

307
00:13:17,000 --> 00:13:15,960
isn't inflated these two might be but

308
00:13:19,160 --> 00:13:17,010
they have working great error bars

309
00:13:21,920 --> 00:13:19,170
they're Koro objects and hopefully I

310
00:13:23,930 --> 00:13:21,930
guess path is going to provide more

311
00:13:26,000 --> 00:13:23,940
information on these and hopefully

312
00:13:29,000 --> 00:13:26,010
better early I constraints there

313
00:13:32,980 --> 00:13:29,010

interestingly that also active the two

314
00:13:35,120 --> 00:13:32,990
of the only active hosts on this figure

315
00:13:37,070 --> 00:13:35,130
but the other thing you'll notice is

316
00:13:38,840 --> 00:13:37,080
that basically the things that are

317
00:13:41,930 --> 00:13:38,850
inflated as a low-mass objects they're

318
00:13:43,760 --> 00:13:41,940
not the higher mass objects okay so how

319
00:13:47,510 --> 00:13:43,770
does this work out when you actually

320
00:13:50,980 --> 00:13:47,520
think about the orbits the host star

321
00:13:53,990 --> 00:13:50,990
temperature how does that help if at all

322
00:13:57,490 --> 00:13:54,000
okay so bear with me on my delightfully

323
00:14:00,470 --> 00:13:57,500
coloured figure here so the color

324
00:14:02,960 --> 00:14:00,480
hopefully you can see it refers to the

325
00:14:05,660 --> 00:14:02,970
temperature of the host star the small

326
00:14:08,420 --> 00:14:05,670
red dots in general are the M dwarfs the

327
00:14:11,660 --> 00:14:08,430
big blue ones are the white dwarfs and

328
00:14:13,610 --> 00:14:11,670
the size of the dot is proportional to

329
00:14:15,380 --> 00:14:13,620
the amount of flux the brown dwarf is

330
00:14:17,120 --> 00:14:15,390
receiving at the surface so this takes

331
00:14:19,550 --> 00:14:17,130
into account the size of the host star

332
00:14:23,780 --> 00:14:19,560
the temperature of the host star and the

333
00:14:26,120 --> 00:14:23,790
period so looking at this you can see

334
00:14:27,470 --> 00:14:26,130
that there are there's quite a few here

335
00:14:29,810 --> 00:14:27,480
that are getting a fair amount of

336
00:14:31,460 --> 00:14:29,820
irradiation but this one is telling

337
00:14:34,850 --> 00:14:31,470
about the same amount and that objects

338
00:14:36,530 --> 00:14:34,860

not massively inflated object at all

339
00:14:38,840 --> 00:14:36,540
between this M dwarf well okay it's got

340
00:14:41,210 --> 00:14:38,850
a large error bars but do you believe

341
00:14:42,380 --> 00:14:41,220
that's yeah it's getting a lot less

342
00:14:45,230 --> 00:14:42,390
irradiation than everything else it's

343
00:14:47,000 --> 00:14:45,240
not inflated this brown dwarf orbiting

344
00:14:49,940 --> 00:14:47,010
the white dwarf is getting a huge amount

345
00:14:53,180 --> 00:14:49,950
of irradiation and it's not inflated so

346
00:14:55,220 --> 00:14:53,190
it appears to me looking at this and I'm

347
00:14:57,890 --> 00:14:55,230
willing to be corrected and take input

348
00:14:59,270 --> 00:14:57,900
from people on this that the dominant

349
00:15:00,500 --> 00:14:59,280
factor as to whether you can inflate

350
00:15:02,600 --> 00:15:00,510
your brown dwarf orbiting a main

351
00:15:04,010 --> 00:15:02,610
sequence star is simply the mass of the

352
00:15:06,440 --> 00:15:04,020
brown dwarf it doesn't appear to be

353
00:15:08,330 --> 00:15:06,450
hugely correlated to the amount of

354
00:15:10,160 --> 00:15:08,340
irradiation you're pumping into that

355
00:15:13,580 --> 00:15:10,170
brown dwarf it's to do with the mass the

356
00:15:15,440 --> 00:15:13,590
burned off itself okay so I'm going to

357
00:15:17,950 --> 00:15:15,450
finish up here and hopefully I've

358
00:15:21,080 --> 00:15:17,960
convinced you we can directly observe

359
00:15:23,270 --> 00:15:21,090
aronia to runoff atmospheres and that

360
00:15:25,100 --> 00:15:23,280
from admittedly the two objects were

361
00:15:26,660 --> 00:15:25,110
looking at at the moment that doesn't

362
00:15:29,150 --> 00:15:26,670
appear to be a clear link between more

363
00:15:31,730 --> 00:15:29,160

UVA radiation and more emission features

364
00:15:34,700 --> 00:15:31,740
in the brand or Fatma sphere and that a

365
00:15:35,930 --> 00:15:34,710
hotter shorter period doesn't equate

366
00:15:38,300 --> 00:15:35,940
more emission lines in the ground or

367
00:15:39,650 --> 00:15:38,310
Fatma sphere and that more radiation

368
00:15:43,010 --> 00:15:39,660
doesn't necessarily indicate more

369
00:15:44,660 --> 00:15:43,020
relation the Randolph either and it does

370
00:15:46,460 --> 00:15:44,670
appear at the moment that in the two

371
00:15:47,960 --> 00:15:46,470
brand also you have data for UVA mission

372
00:15:50,210 --> 00:15:47,970
is linked to or brightening in the cabe

373
00:15:52,550 --> 00:15:50,220
and although we need more data or more

374
00:15:55,100 --> 00:15:52,560
objects admittedly it's a little tricky

375
00:15:58,160 --> 00:15:55,110
when you've only got nine before we can

376
00:16:21,620 --> 00:15:58,170
confirm this in wood detail so I will

377
00:16:22,760 --> 00:16:21,630
finish there thank you very much okay so

378
00:16:27,350 --> 00:16:22,770
I'll start with the question while we

379
00:16:30,560 --> 00:16:27,360
find the other mic so the the case where

380
00:16:32,510 --> 00:16:30,570
you were comparing the elements that we

381
00:16:34,640 --> 00:16:32,520
see in the brown dwarfs and you and you

382
00:16:37,700 --> 00:16:34,650
said that the cloudy or brown dwarfs

383
00:16:39,260 --> 00:16:37,710
show less elements is that just because

384
00:16:40,490 --> 00:16:39,270
you're masking the spectral features

385
00:16:41,870 --> 00:16:40,500
behind clouds or is it because you're

386
00:16:46,400 --> 00:16:41,880
actually sequestering those elements

387
00:16:48,800 --> 00:16:46,410
into cloud particles marvelous to be

388
00:16:50,390 --> 00:16:48,810

honest really I really don't know you

389
00:16:51,920 --> 00:16:50,400
talk to crystianna helling a lot about

390
00:16:53,720 --> 00:16:51,930
this and I know she's not here yet

391
00:16:56,450 --> 00:16:53,730
because her flight doesn't get in she

392
00:16:59,000 --> 00:16:56,460
won't be here till about 11:00 but we

393
00:17:02,600 --> 00:16:59,010
with WD 157 what we solve a whole range

394
00:17:04,310 --> 00:17:02,610
of elements we suspected there might be

395
00:17:05,990 --> 00:17:04,320
some sort of almost like a chromis fear

396
00:17:09,320 --> 00:17:06,000
and the brand off and that was what we

397
00:17:13,250 --> 00:17:09,330
were seeing for epoch two one two two

398
00:17:15,590 --> 00:17:13,260
telephone number we were less sure we

399
00:17:18,380 --> 00:17:15,600
were surprised we saw much less but it

400
00:17:19,730 --> 00:17:18,390
is a much cloudier object and I will

401
00:17:22,430 --> 00:17:19,740
admit at this point that clouds and not

402
00:17:23,960 --> 00:17:22,440
to my thing so I'm to be honest with you

403
00:17:27,320 --> 00:17:23,970
I'm not really sure there was another

404
00:17:29,960 --> 00:17:27,330
object that shows emission which is a

405
00:17:32,630 --> 00:17:29,970
later type I think it's an elf six and

406
00:17:35,990 --> 00:17:32,640
that system also shows evidence of

407
00:17:37,190 --> 00:17:36,000
having been polluted by rocky material

408
00:17:39,950 --> 00:17:37,200
so there's been some sort of planetary

409
00:17:42,350 --> 00:17:39,960
system there as well but again that

410
00:17:45,260 --> 00:17:42,360
doesn't show it doesn't even show the

411
00:17:48,320 --> 00:17:45,270
same elements as epic - hunty - it shows

412
00:17:51,680 --> 00:17:48,330
different ones so at the moment might

413
00:17:53,470 --> 00:17:51,690

yeah where I am is basically we need a

414
00:17:55,779 --> 00:17:53,480
lot more of these where

415
00:17:57,639 --> 00:17:55,789
a lot more different special types and

416
00:17:59,350 --> 00:17:57,649
levels of irradiation to really have any

417
00:18:04,360 --> 00:17:59,360
sort of idea of being able to say what's

418
00:18:05,620 --> 00:18:04,370
going on so Sarah yeah you'll alluded to

419
00:18:07,480 --> 00:18:05,630
the photochemistry and this keeps coming

420
00:18:10,649 --> 00:18:07,490
up so I just like to continue this theme

421
00:18:13,509 --> 00:18:10,659
so for the case of the the mysterious

422
00:18:14,980 --> 00:18:13,519
absent emission lines I'm just wondering

423
00:18:18,190 --> 00:18:14,990
whether the photochemistry itself would

424
00:18:20,769 --> 00:18:18,200
just drive the disappearance of the

425
00:18:22,840 --> 00:18:20,779
neutrals or the singly ionized species

426
00:18:26,049 --> 00:18:22,850
which are responsible for these sodium

427
00:18:27,460 --> 00:18:26,059
is very susceptible yeah I ins ation and

428
00:18:30,610 --> 00:18:27,470
so wouldn't surprise me if there's just

429
00:18:35,399 --> 00:18:30,620
no neutral sodium available for emission

430
00:18:37,330 --> 00:18:35,409
in the D lines and then related to that

431
00:18:39,580 --> 00:18:37,340
something perhaps you thought about I

432
00:18:42,129 --> 00:18:39,590
haven't even wrap my head around this

433
00:18:44,950 --> 00:18:42,139
yet dissociation of actually some of the

434
00:18:47,950 --> 00:18:44,960
molecules responsible for opacity in

435
00:18:50,590 --> 00:18:47,960
these objects in addition to the issues

436
00:18:55,029 --> 00:18:50,600
of clouds so the the titanium vanadium

437
00:18:57,519 --> 00:18:55,039
oxides will ionize at some point and I

438
00:18:59,830 --> 00:18:57,529

wonder if that could somehow modulate

439
00:19:02,590 --> 00:18:59,840
the temperature structure and the

440
00:19:04,690 --> 00:19:02,600
thermal budget and maybe related to

441
00:19:06,940 --> 00:19:04,700
something you've seen in the KP out of

442
00:19:10,180 --> 00:19:06,950
mission yeah so that was something we

443
00:19:12,879 --> 00:19:10,190
looked into a little bit with wgo a 137

444
00:19:14,649 --> 00:19:12,889
particularly the Tattaglia mach side his

445
00:19:16,360 --> 00:19:14,659
warming up when we originally looked at

446
00:19:19,539 --> 00:19:16,370
the dayside nights our temperatures we

447
00:19:21,610 --> 00:19:19,549
sort of went okay is this is it's a

448
00:19:23,019 --> 00:19:21,620
temperature inversion this is what

449
00:19:25,600 --> 00:19:23,029
everybody has been saying should happen

450
00:19:27,310 --> 00:19:25,610
in exoplanets and then we sort of looked

451
00:19:28,779 --> 00:19:27,320
at it a little bit more detail we looked

452
00:19:30,639 --> 00:19:28,789
at the models we looked at the

453
00:19:33,129 --> 00:19:30,649
temperature pressure scale heights from

454
00:19:35,110 --> 00:19:33,139
jonathan and marks models and we sort of

455
00:19:37,240 --> 00:19:35,120
came to the conclusion that that really

456
00:19:40,480 --> 00:19:37,250
wasn't likely to be the case for this

457
00:19:43,450 --> 00:19:40,490
object here and that photochemistry was

458
00:19:45,310 --> 00:19:43,460
possibly the most likely thing that's

459
00:19:47,470 --> 00:19:45,320
going on I mean ideally we need face

460
00:19:48,970 --> 00:19:47,480
with all spectroscopy in the cave and at

461
00:19:51,730 --> 00:19:48,980
three point six and four point five

462
00:19:55,720 --> 00:19:51,740
microns but even at you know with a

463
00:19:58,720 --> 00:19:55,730

two-hour period and that objects 15th

464
00:20:01,149 --> 00:19:58,730
magnitude that's still really tough to

465
00:20:02,740 --> 00:20:01,159
get short enough cadence in your

466
00:20:04,659 --> 00:20:02,750
spectroscopy in the infrared to actually

467
00:20:08,840 --> 00:20:04,669
get something sensible out of there it's

468
00:20:15,260 --> 00:20:12,410
hi Sara nice a I'm this may be a naive

469
00:20:16,580 --> 00:20:15,270
question and but do you consider it's

470
00:20:18,590 --> 00:20:16,590
impossible to have a reflected light

471
00:20:23,030 --> 00:20:18,600
from these objects and does that add to

472
00:20:26,750 --> 00:20:23,040
your anomalously deep so and I'm willing

473
00:20:29,390 --> 00:20:26,760
to be corrected but when I talk when I

474
00:20:34,610 --> 00:20:29,400
talk to people over the horrible static

475
00:20:36,290 --> 00:20:34,620
that I'm currently the suggestion has

476
00:20:39,590 --> 00:20:36,300
been that the reflection like mainly is

477
00:20:44,030 --> 00:20:39,600
going to show up in the optical and I

478
00:20:45,980 --> 00:20:44,040
have sent my like curve 2wd r17 to mark

479
00:20:47,600 --> 00:20:45,990
Molly at some point last summer and he

480
00:20:49,570 --> 00:20:47,610
was going to have something look look at

481
00:20:52,010 --> 00:20:49,580
that in particularly to look at the

482
00:20:53,720 --> 00:20:52,020
reflected light reflected light from

483
00:20:55,160 --> 00:20:53,730
clouds there anything whether anything

484
00:20:58,280 --> 00:20:55,170
like that's going on so these things

485
00:21:01,610 --> 00:20:58,290
vary at the 1 to 3 percent level in the

486
00:21:04,060 --> 00:21:01,620
optical and it's almost 30 ish percent

487
00:21:05,930 --> 00:21:04,070
by the time you get to the cave and okay

488
00:21:10,580 --> 00:21:05,940

I'm not sure that answered you

489
00:21:19,790 --> 00:21:10,590
necessarily okay actually I would ask a

490
00:21:21,169 --> 00:21:19,800
question so I was interested in the

491
00:21:23,210 --> 00:21:21,179
dayside night side and we have a

492
00:21:25,790 --> 00:21:23,220
contrast putt so a parameter that's

493
00:21:28,970 --> 00:21:25,800
relevant for irradiated groundworks

494
00:21:31,190 --> 00:21:28,980
that's not so much an issue for for hot

495
00:21:34,160 --> 00:21:31,200
Jupiters is the ratio of the flux coming

496
00:21:35,810 --> 00:21:34,170
out of the interior to the illumination

497
00:21:37,549 --> 00:21:35,820
that is just right what extent can you

498
00:21:39,470 --> 00:21:37,559
estimate the flux coming out of the

499
00:21:41,419 --> 00:21:39,480
interior from the age from the

500
00:21:44,590 --> 00:21:41,429
equilibrium temperature we do we just

501
00:21:47,510 --> 00:21:44,600
not know that I have no idea but I might

502
00:21:51,760 --> 00:21:47,520
pick on Jonathan and see if Jonathan

503
00:21:56,270 --> 00:21:54,169
mean I don't know off the top of my head

504
00:21:57,980 --> 00:21:56,280
but yeah if we have a mass and a decent

505
00:22:03,860 --> 00:21:57,990
age then you should be able to constrain

506
00:22:23,940 --> 00:22:03,870
the flux from interior pretty well not

507
00:22:36,970 --> 00:22:32,890
yeah yeah so you could you could if we

508
00:22:41,680 --> 00:22:36,980
take the the spectral type at face value

509
00:22:44,230 --> 00:22:41,690
if you like and use albedo etc for non

510
00:22:47,560 --> 00:22:44,240
aeration systems then yeah I guess you

511
00:22:53,380 --> 00:22:47,570
could you for work about food look into

512
00:22:55,430 --> 00:22:53,390
it I will have a think about that thanks