
AbSciCon
2019

1
00:00:00,790 --> 00:00:07,320
[Music]

2
00:00:11,600 --> 00:00:09,310
[Applause]

3
00:00:13,520 --> 00:00:11,610
Thank You Julian since I was first one

4
00:00:15,200 --> 00:00:13,530
I'll just go ahead and say that I'm a

5
00:00:17,120 --> 00:00:15,210
little bit sheepish to be listed as a

6
00:00:18,769 --> 00:00:17,130
co-organizer for this and actually be

7
00:00:21,260 --> 00:00:18,779
the first pro I did not put myself as

8
00:00:22,670 --> 00:00:21,270
first here so please remember that the

9
00:00:24,440 --> 00:00:22,680
other people who get the credit here are

10
00:00:26,690 --> 00:00:24,450
Julie in particular Eric Parker and

11
00:00:27,890 --> 00:00:26,700
Jamie also cook Hosea Ponte and a few

12
00:00:30,140 --> 00:00:27,900
others they're listed somewhere in the

13
00:00:32,810 --> 00:00:30,150

program and I'm afraid that I was not

14
00:00:35,120 --> 00:00:32,820
very valuable to the team about

15
00:00:37,819 --> 00:00:35,130
contributing but they let me talk anyway

16
00:00:39,800 --> 00:00:37,829
anyway I'd like to talk about something

17
00:00:43,490 --> 00:00:39,810
fairly simple actually aliphatic

18
00:00:45,229 --> 00:00:43,500
compounds it's a group of compounds that

19
00:00:47,299 --> 00:00:45,239
are generally speaking not nearly as

20
00:00:48,529 --> 00:00:47,309
well studied as some of the aromatics

21
00:00:50,569 --> 00:00:48,539
that you heard about yesterday and a

22
00:00:52,880 --> 00:00:50,579
number of the aromatic speakers or their

23
00:00:55,130 --> 00:00:52,890
compounds are aromatic who are sitting

24
00:00:56,990 --> 00:00:55,140
here yesterday some of those people and

25
00:00:58,400 --> 00:00:57,000
so this is a different group so if

26
00:00:59,869 --> 00:00:58,410
you're if you're not familiar I'll show

27
00:01:01,849 --> 00:00:59,879
you a picture here in a few minutes so

28
00:01:04,009 --> 00:01:01,859
the other aliphatic the other cyclic

29
00:01:08,360 --> 00:01:04,019
organic compounds in case you don't know

30
00:01:11,210 --> 00:01:08,370
me let me just say that we see if this

31
00:01:13,490 --> 00:01:11,220
works yes we have a laboratory the

32
00:01:14,780 --> 00:01:13,500
Goddard Space Flight Center this could

33
00:01:16,160 --> 00:01:14,790
be pictures of any place this could be

34
00:01:18,140 --> 00:01:16,170
pictures University of Washington but

35
00:01:19,910 --> 00:01:18,150
trust me this is from near Washington DC

36
00:01:22,249 --> 00:01:19,920
this is actually our laboratory not just

37
00:01:24,260 --> 00:01:22,259
any generic pictures from Wikipedia and

38
00:01:25,969 --> 00:01:24,270

we do three things we do planetary

39
00:01:28,039 --> 00:01:25,979
science we do some interstellar

40
00:01:30,440 --> 00:01:28,049
chemistry interstellar astrophysics and

41
00:01:32,020 --> 00:01:30,450
we do astrobiology so over the 15 years

42
00:01:33,920 --> 00:01:32,030
or so we've been involved in Nai

43
00:01:36,620 --> 00:01:33,930
astrobiology has been a wonderful way to

44
00:01:38,330 --> 00:01:36,630
tie together those two to end members to

45
00:01:40,490 --> 00:01:38,340
extremes era planetary science and in

46
00:01:42,950 --> 00:01:40,500
interstellar chemistry so thank you very

47
00:01:45,200 --> 00:01:42,960
much I give the the commercial right

48
00:01:47,270 --> 00:01:45,210
here for the DNA I and the Goddard

49
00:01:50,450 --> 00:01:47,280
Center for astrobiology the things we

50
00:01:52,760 --> 00:01:50,460
study tend to be cold we think of

51
00:01:54,440 --> 00:01:52,770
ourselves as going from Mars outward you

52
00:01:56,870 --> 00:01:54,450
know the temperature of Mars is a little

53
00:01:59,929 --> 00:01:56,880
bit high on our range of the thermometer

54
00:02:01,370 --> 00:01:59,939
and we go outward towards us I guess

55
00:02:03,230 --> 00:02:01,380
we've done a small amount of Mars was so

56
00:02:05,240 --> 00:02:03,240
small amount of Jupiter and small about

57
00:02:06,770 --> 00:02:05,250
asteroids and going out really toward a

58
00:02:09,320 --> 00:02:06,780
Europa inclu toe and the interstellar

59
00:02:10,609 --> 00:02:09,330
medium and commentary Isis so this is

60
00:02:12,050 --> 00:02:10,619
sort of range we're talking about so

61
00:02:14,480 --> 00:02:12,060
almost everything whenever I give a talk

62
00:02:16,490 --> 00:02:14,490
it's it's focusing on the solid phase as

63
00:02:18,650 --> 00:02:16,500

opposed to the gas phase and I don't

64
00:02:20,030 --> 00:02:18,660
think in 30 years or whatever it's being

65
00:02:21,540 --> 00:02:20,040
I've ever talked about the liquid phase

66
00:02:23,370 --> 00:02:21,550
I'm not going to talk about

67
00:02:25,680 --> 00:02:23,380
a comet striking the ocean or something

68
00:02:27,870 --> 00:02:25,690
like that so here we go if you've taken

69
00:02:29,550 --> 00:02:27,880
organic chemistry seen this before her

70
00:02:32,070 --> 00:02:29,560
just been around the block you've heard

71
00:02:33,810 --> 00:02:32,080
of aromatic and aliphatic compounds so

72
00:02:35,970 --> 00:02:33,820
aromatics are there on the left the the

73
00:02:38,940 --> 00:02:35,980
famous benzene ring it was isolated by a

74
00:02:41,400 --> 00:02:38,950
Faraday and worked out by calculate some

75
00:02:42,750 --> 00:02:41,410
where in the 1800's and at the bottom

76
00:02:44,160 --> 00:02:42,760
there one of the early Meyer man I

77
00:02:45,480 --> 00:02:44,170
forgotten which Erlenmeyer it was well

78
00:02:47,760 --> 00:02:45,490
one of the early Myers worked out the

79
00:02:50,070 --> 00:02:47,770
the naphthalene down the bottom left I

80
00:02:52,080 --> 00:02:50,080
can point this down here you've heard of

81
00:02:53,670 --> 00:02:52,090
these and and these are interesting of

82
00:02:55,920 --> 00:02:53,680
course but for astrobiology maybe these

83
00:02:57,690 --> 00:02:55,930
are even more exciting the the nuclear

84
00:02:59,820 --> 00:02:57,700
bases that you find inside of you right

85
00:03:01,980 --> 00:02:59,830
now nucleobases are aromatic flat

86
00:03:04,080 --> 00:03:01,990
compounds have this so-called

87
00:03:05,490 --> 00:03:04,090
delocalization these are lines here in

88
00:03:07,920 --> 00:03:05,500

case you forgotten these mean extra

89
00:03:10,440 --> 00:03:07,930
electrons two extra electrons for every

90
00:03:11,850 --> 00:03:10,450
extra line there so these these are well

91
00:03:13,110 --> 00:03:11,860
steady there are lots of lots of work

92
00:03:14,700 --> 00:03:13,120
finding these things in meteorites

93
00:03:16,530 --> 00:03:14,710
looking for these things in interstellar

94
00:03:18,060 --> 00:03:16,540
space studying these things the

95
00:03:20,190 --> 00:03:18,070
laboratory studying these of course in

96
00:03:23,190 --> 00:03:20,200
vivo lots of work and so forth

97
00:03:24,960 --> 00:03:23,200
in contrast these have been not nearly

98
00:03:26,910 --> 00:03:24,970
as well studied the ring compounds of

99
00:03:28,440 --> 00:03:26,920
the right hand side there and part of

100
00:03:30,090 --> 00:03:28,450
the reason is that I'm a chemistry

101
00:03:31,500 --> 00:03:30,100
person and the chemists tend to have a

102
00:03:33,720 --> 00:03:31,510
little bit of a bias against these

103
00:03:36,300 --> 00:03:33,730
things over here because of the way that

104
00:03:38,370 --> 00:03:36,310
they they're bonded together here the

105
00:03:40,890 --> 00:03:38,380
sort of natural bonding that you find

106
00:03:43,560 --> 00:03:40,900
for carbon is bond angles like 109

107
00:03:45,390 --> 00:03:43,570
degrees or 110 or 120 and occasionally

108
00:03:47,430 --> 00:03:45,400
hundred eighty but once you start

109
00:03:49,110 --> 00:03:47,440
getting to bond angles like ninety

110
00:03:51,630 --> 00:03:49,120
degrees with the carbon the square and

111
00:03:53,520 --> 00:03:51,640
the triangle of 6000 the molecule is

112
00:03:55,770 --> 00:03:53,530
just not happy and we know this because

113
00:03:57,600 --> 00:03:55,780

of a man named Adolf von Behr who got

114
00:03:59,250 --> 00:03:57,610
the Nobel Prize for working this out

115
00:04:00,540 --> 00:03:59,260
over a hundred years ago who told us

116
00:04:02,460 --> 00:04:00,550
that these molecules are what he called

117
00:04:03,960 --> 00:04:02,470
strained if you look at these the wrong

118
00:04:06,090 --> 00:04:03,970
way they began to react and to break

119
00:04:08,880 --> 00:04:06,100
apart and to isomerize and things like

120
00:04:11,100 --> 00:04:08,890
that there none of these compounds like

121
00:04:13,110 --> 00:04:11,110
this as sort of saturated compounds have

122
00:04:14,610 --> 00:04:13,120
all the four bonds taking care of with

123
00:04:16,650 --> 00:04:14,620
four atoms none of these things are

124
00:04:18,479 --> 00:04:16,660
really known you know definitively

125
00:04:19,860 --> 00:04:18,489
floating around the interstellar medium

126
00:04:21,449 --> 00:04:19,870
they're still looking for these things

127
00:04:23,850 --> 00:04:21,459
and I'll come back to that before we're

128
00:04:26,160 --> 00:04:23,860
done just because we have a little bit

129
00:04:28,620 --> 00:04:26,170
of a bias against these in our minds and

130
00:04:30,719 --> 00:04:28,630
as a canvas doesn't mean that that

131
00:04:32,310 --> 00:04:30,729
nature has a bias because you do find it

132
00:04:33,659 --> 00:04:32,320
that these things are out there in

133
00:04:34,760 --> 00:04:33,669
nature and I never really knew this

134
00:04:36,110 --> 00:04:34,770
until about a year ago

135
00:04:38,270 --> 00:04:36,120
when we had a student working on this

136
00:04:40,010 --> 00:04:38,280
and she went to an old-fashioned library

137
00:04:44,149 --> 00:04:40,020
and found some old-fashioned books and

138
00:04:45,529 --> 00:04:44,159

actually books one of those things we

139
00:04:49,480 --> 00:04:45,539
used to have before we had the internet

140
00:04:52,550 --> 00:04:49,490
and she found that there there are

141
00:04:54,950 --> 00:04:52,560
natural products that you have in nature

142
00:04:56,600 --> 00:04:54,960
natural products in nature that that

143
00:04:58,189 --> 00:04:56,610
have these three membered rings and

144
00:05:00,170 --> 00:04:58,199
there's a triangle here and a triangle

145
00:05:02,390 --> 00:05:00,180
over here somewhere and amino acid

146
00:05:03,460 --> 00:05:02,400
steroids and so forth and I never knew

147
00:05:06,320 --> 00:05:03,470
this I never knew that you had

148
00:05:07,430 --> 00:05:06,330
cyclopropyl rings just kind of floating

149
00:05:08,749 --> 00:05:07,440
around us I thought this is something

150
00:05:11,120 --> 00:05:08,759
you bought from the signal altars

151
00:05:12,439 --> 00:05:11,130
chemical company and so forth but it

152
00:05:14,390 --> 00:05:12,449
turns out there aren't natural products

153
00:05:17,420 --> 00:05:14,400
nature is not as biased against these as

154
00:05:19,399 --> 00:05:17,430
maybe we ourselves are sometimes and so

155
00:05:21,020 --> 00:05:19,409
we began to wonder what what is that

156
00:05:22,580 --> 00:05:21,030
it's known about this from the point of

157
00:05:24,050 --> 00:05:22,590
view of low-temperature chemistry and

158
00:05:26,029 --> 00:05:24,060
why haven't we found some of these

159
00:05:27,709 --> 00:05:26,039
things in the interstellar or our cold

160
00:05:29,180 --> 00:05:27,719
environments and we looked in the

161
00:05:32,450 --> 00:05:29,190
literature and we found that one problem

162
00:05:34,369 --> 00:05:32,460
is a lot of the things we'd like to know

163
00:05:36,260 --> 00:05:34,379

about these things just or not have not

164
00:05:37,279 --> 00:05:36,270
been studied just things like you know

165
00:05:38,719 --> 00:05:37,289
how do you make these in cold

166
00:05:40,790 --> 00:05:38,729
environments there's a little bit of

167
00:05:43,189 --> 00:05:40,800
work on that fundamental properties with

168
00:05:44,689 --> 00:05:43,199
some of these molecules stability and

169
00:05:46,129 --> 00:05:44,699
radiation environments radiations

170
00:05:47,870 --> 00:05:46,139
essentially everywhere once you get

171
00:05:48,890 --> 00:05:47,880
below a meter or so and Europa you've

172
00:05:50,959 --> 00:05:48,900
still got you know you've got to worry

173
00:05:53,330 --> 00:05:50,969
about radiation once you get unless

174
00:05:55,219 --> 00:05:53,340
you're up meters below reaction

175
00:05:56,719 --> 00:05:55,229
chemistry you know lots of liquid phase

176
00:05:58,550 --> 00:05:56,729
chemistry gas phase chemistry

177
00:06:01,070 --> 00:05:58,560
biochemists but solid phase chemistry

178
00:06:03,290 --> 00:06:01,080
lots of cold environments in space this

179
00:06:04,939 --> 00:06:03,300
sort of work just hasn't been done so

180
00:06:06,110 --> 00:06:04,949
I'm going to blast through a few simple

181
00:06:07,879 --> 00:06:06,120
things here and then I'm going to stop

182
00:06:11,059 --> 00:06:07,889
and we'll go to the next speaker so here

183
00:06:12,769 --> 00:06:11,069
a few a few things synthesis okay

184
00:06:14,149 --> 00:06:12,779
sometimes we get the idea that these

185
00:06:16,219 --> 00:06:14,159
meetings at chemistry started or

186
00:06:18,529 --> 00:06:16,229
astrobiology started in the year 2000 it

187
00:06:20,570 --> 00:06:18,539
did not you know this first reaction up

188
00:06:22,670 --> 00:06:20,580

here is a century old this is called

189
00:06:23,570 --> 00:06:22,680
what's this called anybody knows shout

190
00:06:28,550 --> 00:06:23,580
it out if you know what the kind of

191
00:06:30,170 --> 00:06:28,560
reaction this is well epoxidation this

192
00:06:31,610 --> 00:06:30,180
epoxidation reaction it goes back at

193
00:06:33,409 --> 00:06:31,620
least a hundred years I don't know that

194
00:06:35,360 --> 00:06:33,419
the Ukrainian Journal of chemistry I

195
00:06:37,969 --> 00:06:35,370
think it was a reported the first first

196
00:06:39,469 --> 00:06:37,979
instance of epoxidation long ago so this

197
00:06:41,839 --> 00:06:39,479
is not unusual but but there had been

198
00:06:43,990 --> 00:06:41,849
people like Patrice Cole up here and

199
00:06:47,450 --> 00:06:44,000
from my colleague French colleague here

200
00:06:47,800 --> 00:06:47,460
Julie's a pro tree skull has studied

201
00:06:50,590 --> 00:06:47,810
this

202
00:06:52,750 --> 00:06:50,600
the simulated Titan atmosphere and found

203
00:06:54,460 --> 00:06:52,760
that just a little bit of oxygen then

204
00:06:56,200 --> 00:06:54,470
you can have hydrocarbons capturing the

205
00:06:57,670 --> 00:06:56,210
oxygen in Titan's atmosphere and

206
00:06:59,950 --> 00:06:57,680
starting to make a rings like this as

207
00:07:02,379 --> 00:06:59,960
ethylene oxide and the same type of

208
00:07:03,730 --> 00:07:02,389
reaction here this is a siege to carbon

209
00:07:05,650 --> 00:07:03,740
chemistry methylene you can make these

210
00:07:07,960 --> 00:07:05,660
same sort of triangles here this is not

211
00:07:09,520 --> 00:07:07,970
new this is a really old stuff and so

212
00:07:11,470 --> 00:07:09,530
for that reason we've not devoted much

213
00:07:13,180 --> 00:07:11,480

time to it you know it's all in the

214
00:07:15,430 --> 00:07:13,190
literature see me I'll give you the

215
00:07:17,550 --> 00:07:15,440
references it's easy to find if you have

216
00:07:19,480 --> 00:07:17,560
hydrocarbon deposits on Pluto and you do

217
00:07:20,650 --> 00:07:19,490
hydrocarbon deposits on Pluto you're

218
00:07:22,570 --> 00:07:20,660
going to get this sort of chemistry over

219
00:07:24,900 --> 00:07:22,580
here just it's just you can't stop it

220
00:07:27,610 --> 00:07:24,910
that's one of those things so we went on

221
00:07:29,170 --> 00:07:27,620
looking at other types of molecules with

222
00:07:31,450 --> 00:07:29,180
this ring structure here here are five

223
00:07:33,879 --> 00:07:31,460
that have the cyclopropyl ring structure

224
00:07:36,159 --> 00:07:33,889
and two two ethers over here these two

225
00:07:37,780 --> 00:07:36,169
are known as interstellar we recorded

226
00:07:39,280 --> 00:07:37,790
infrared spectra these things most of

227
00:07:41,350 --> 00:07:39,290
these things never been recorded there's

228
00:07:42,820 --> 00:07:41,360
some very nice isomerization processes

229
00:07:45,129 --> 00:07:42,830
that you can see up your conformational

230
00:07:48,010 --> 00:07:45,139
changes that you can study I'm not going

231
00:07:50,050 --> 00:07:48,020
to talk about that but instead just just

232
00:07:51,969 --> 00:07:50,060
saying something as simple it's what's

233
00:07:53,800 --> 00:07:51,979
the index refraction of cyclopropanes

234
00:07:56,080 --> 00:07:53,810
solid I don't know why anybody would

235
00:07:57,400 --> 00:07:56,090
ever want to know that but we did you

236
00:07:59,890 --> 00:07:57,410
know we want to know what's the what's

237
00:08:01,450 --> 00:07:59,900
the density of solid cyclopropane and so

238
00:08:03,520 --> 00:08:01,460

you go out and try to measure these

239
00:08:05,469 --> 00:08:03,530
things the literature and you just out

240
00:08:07,600 --> 00:08:05,479
of luck so if you study this sort of

241
00:08:09,580 --> 00:08:07,610
stuff what do you do what you do is you

242
00:08:11,590 --> 00:08:09,590
look up what the liquids are like use

243
00:08:13,960 --> 00:08:11,600
liquid phase data instead of solid phase

244
00:08:15,460 --> 00:08:13,970
data so liquids are here on the left on

245
00:08:17,469 --> 00:08:15,470
the star in the vertical and the

246
00:08:19,180 --> 00:08:17,479
horizontal is Isis and if you can see a

247
00:08:20,860 --> 00:08:19,190
correlation there please see me because

248
00:08:23,440 --> 00:08:20,870
we probably have a job for you later I

249
00:08:24,490 --> 00:08:23,450
cannot see a correlation any of that it

250
00:08:25,600 --> 00:08:24,500
looks like you know one of these things

251
00:08:27,040 --> 00:08:25,610
where my children would take a

252
00:08:28,510 --> 00:08:27,050
paintbrush and throw it up against the

253
00:08:30,190 --> 00:08:28,520
easel you know splatter or something

254
00:08:31,779 --> 00:08:30,200
like that and so you wonder about the

255
00:08:33,190 --> 00:08:31,789
validity of your measurements that this

256
00:08:34,659 --> 00:08:33,200
is what you're getting do it do we waste

257
00:08:36,520 --> 00:08:34,669
our time for a month trying to do all

258
00:08:38,290 --> 00:08:36,530
this sort of stuff but there is a way

259
00:08:40,870 --> 00:08:38,300
believe it or not that you can combine

260
00:08:43,240 --> 00:08:40,880
these two things here and start to check

261
00:08:44,650 --> 00:08:43,250
to see if you've done your job well see

262
00:08:46,840 --> 00:08:44,660
if you've made you me and you have to be

263
00:08:49,269 --> 00:08:46,850

over 55 I think to understand this it's

264
00:08:50,800 --> 00:08:49,279
a property called molar refraction which

265
00:08:52,540 --> 00:08:50,810
has hardly ever taught any more molar

266
00:08:54,610 --> 00:08:52,550
refraction it's a way that you can

267
00:08:56,650 --> 00:08:54,620
combine these two things together which

268
00:08:58,270 --> 00:08:56,660
looks like nonsense and come up with

269
00:08:59,710 --> 00:08:58,280
something that seems to make sense and

270
00:09:01,210 --> 00:08:59,720
so here it is even if you've never heard

271
00:09:02,800 --> 00:09:01,220
the words molar refraction but

272
00:09:04,540 --> 00:09:02,810
or I hope you'll be impressed by that

273
00:09:06,670 --> 00:09:04,550
straight line the straight line

274
00:09:08,019 --> 00:09:06,680
everybody likes and this is just

275
00:09:09,519 --> 00:09:08,029
something's not taught very often

276
00:09:11,199 --> 00:09:09,529
anymore the motor except maybe the

277
00:09:12,879 --> 00:09:11,209
engineers and some material scientists

278
00:09:13,900 --> 00:09:12,889
so we're very happy when we got this

279
00:09:15,610 --> 00:09:13,910
this told us what we were measuring

280
00:09:17,559 --> 00:09:15,620
these things properly molar a fraction

281
00:09:19,389 --> 00:09:17,569
of a solid versus liquid and we get a

282
00:09:20,860 --> 00:09:19,399
nice pretty straight line that's one

283
00:09:21,400 --> 00:09:20,870
example of what we call a fundamental

284
00:09:25,509 --> 00:09:21,410
property

285
00:09:27,400 --> 00:09:25,519
related to astrobiology instability and

286
00:09:29,019 --> 00:09:27,410
radiation environments we measure how

287
00:09:30,699 --> 00:09:29,029
fast these things these molecules are

288
00:09:31,990 --> 00:09:30,709

destroyed if you expose these to

289
00:09:34,509 --> 00:09:32,000
ionizing radiation at a low temperature

290
00:09:36,790 --> 00:09:34,519
and I've just picked six molecules up

291
00:09:38,139 --> 00:09:36,800
here the stars with cyclopropane you

292
00:09:39,910 --> 00:09:38,149
know the mother of all these things the

293
00:09:41,710 --> 00:09:39,920
parent the archetype and then

294
00:09:43,600 --> 00:09:41,720
cyclopropanes here if we let ethylene

295
00:09:45,550 --> 00:09:43,610
oxide just give it a number one to

296
00:09:47,619 --> 00:09:45,560
normalize everything and what this means

297
00:09:50,139 --> 00:09:47,629
is it takes 32 times as much radiation

298
00:09:52,569 --> 00:09:50,149
to destroy half your benzene sample as

299
00:09:53,980 --> 00:09:52,579
it does the ethylene oxide and so the

300
00:09:56,679 --> 00:09:53,990
important part here is the cyclopropane

301
00:09:58,420 --> 00:09:56,689
is not you know on the extremes it's in

302
00:09:59,860 --> 00:09:58,430
the middle here somewhere all these

303
00:10:01,379 --> 00:09:59,870
other things have been found in various

304
00:10:03,879 --> 00:10:01,389
places in extraterrestrial environments

305
00:10:06,639 --> 00:10:03,889
ethylene oxide propylene oxide first

306
00:10:08,170 --> 00:10:06,649
chiral molecule found in in space of

307
00:10:10,449 --> 00:10:08,180
years ago in space from both radio

308
00:10:12,429 --> 00:10:10,459
telescopes so cyclopropanes sort of in

309
00:10:14,769 --> 00:10:12,439
the middle and if you want their actual

310
00:10:16,360 --> 00:10:14,779
data you know don't go and hack JPL or

311
00:10:17,769 --> 00:10:16,370
god or anything like that just asked me

312
00:10:18,850 --> 00:10:17,779
will give it to you you know what we

313
00:10:20,139 --> 00:10:18,860

don't we don't have any secrets here

314
00:10:21,970 --> 00:10:20,149
anything like they just ask us and we'll

315
00:10:24,340 --> 00:10:21,980
give you the data we can tell you sort

316
00:10:25,689 --> 00:10:24,350
of a rough idea you know how long one of

317
00:10:28,720 --> 00:10:25,699
these molecules these three membered

318
00:10:30,429 --> 00:10:28,730
rings hang around and europa not long

319
00:10:32,769 --> 00:10:30,439
you know we're talking about years here

320
00:10:35,049 --> 00:10:32,779
you know nasa wisely does not let me

321
00:10:37,569 --> 00:10:35,059
speak officially but unofficially as a

322
00:10:39,699 --> 00:10:37,579
scientist i would say that you need to

323
00:10:41,079 --> 00:10:39,709
dig down a metre so before you really

324
00:10:42,730 --> 00:10:41,089
get to the good stuff on a place like

325
00:10:44,889 --> 00:10:42,740
Europa the radiation is going to tear

326
00:10:46,749 --> 00:10:44,899
you up on the surface the interstellar

327
00:10:48,999 --> 00:10:46,759
medium these things last a long long

328
00:10:50,350 --> 00:10:49,009
time millions of years but it's going to

329
00:10:52,929 --> 00:10:50,360
be a long time before we get to the

330
00:10:54,970 --> 00:10:52,939
interstellar medium flying space travel

331
00:10:56,350 --> 00:10:54,980
here's the trick the radio astronomers

332
00:10:58,389 --> 00:10:56,360
use when they want to find something

333
00:11:00,850 --> 00:10:58,399
that has no dipole moment nice beautiful

334
00:11:02,470 --> 00:11:00,860
symmetrical molecules like benzene what

335
00:11:04,179 --> 00:11:02,480
they do is to stick a CN group on this

336
00:11:05,949 --> 00:11:04,189
thing this gives it a whopping dipole

337
00:11:07,990 --> 00:11:05,959
moment it's like a flag you know waving

338
00:11:09,400 --> 00:11:08,000

the flag Here I am and so what we've

339
00:11:11,199 --> 00:11:09,410
proposed is the same sort of thing if

340
00:11:13,360 --> 00:11:11,209
you want to find cyclopropane no dipole

341
00:11:14,410 --> 00:11:13,370
moment what you do instead is you look

342
00:11:16,509 --> 00:11:14,420
for something in a

343
00:11:18,940 --> 00:11:16,519
Evon evolved it a cyano group here and

344
00:11:20,920 --> 00:11:18,950
so naturally we have to to see what sort

345
00:11:22,690 --> 00:11:20,930
of reactions that thing will undergo and

346
00:11:24,639 --> 00:11:22,700
so here's one radiation this has been

347
00:11:27,220 --> 00:11:24,649
known since I guess the 1930s this thing

348
00:11:28,990 --> 00:11:27,230
of summarizes this is some work I did

349
00:11:30,610 --> 00:11:29,000
with Marlon more some years ago but this

350
00:11:32,350 --> 00:11:30,620
one does the same thing we've measured

351
00:11:33,970 --> 00:11:32,360
this reaction we looked at this hope to

352
00:11:37,090 --> 00:11:33,980
publish this in the next next few months

353
00:11:38,889 --> 00:11:37,100
and so you get a nice isomerization this

354
00:11:42,400 --> 00:11:38,899
is a place I will invite collaboration

355
00:11:44,560 --> 00:11:42,410
because this smells awful it is like

356
00:11:47,710 --> 00:11:44,570
what's the words fat you know there's

357
00:11:49,629 --> 00:11:47,720
old literature papers foul evil you know

358
00:11:51,069 --> 00:11:49,639
all those words like that it smells

359
00:11:53,379 --> 00:11:51,079
terrible but you really do get this sort

360
00:11:55,660 --> 00:11:53,389
of our summarization maybe that's not

361
00:11:57,790 --> 00:11:55,670
important what's important is that it

362
00:11:59,199 --> 00:11:57,800
doesn't just fall apart you know that

363
00:12:00,819 --> 00:11:59,209

you do get these rings with a certain

364
00:12:03,100 --> 00:12:00,829
stability the same story of stability

365
00:12:05,319 --> 00:12:03,110
that you find with molecules are already

366
00:12:08,980 --> 00:12:05,329
known to be interstellar Julie how we

367
00:12:11,350 --> 00:12:08,990
doing for time we've got done okay so

368
00:12:12,910 --> 00:12:11,360
let's just wrap it up real quickly what

369
00:12:14,740 --> 00:12:12,920
have we done you know we took a simple

370
00:12:16,780 --> 00:12:14,750
molecule here simple moment cyclopropane

371
00:12:18,970 --> 00:12:16,790
and some of its derivatives and we

372
00:12:20,860 --> 00:12:18,980
mentioned some physical properties we've

373
00:12:22,300 --> 00:12:20,870
got IR spectra at low temperatures you

374
00:12:23,800 --> 00:12:22,310
know we can actually study these things

375
00:12:26,079 --> 00:12:23,810
in laboratory we can quantify the

376
00:12:28,600 --> 00:12:26,089
samples now six months ago couldn't do

377
00:12:30,250 --> 00:12:28,610
that we measured stabilities looking at

378
00:12:32,319 --> 00:12:30,260
reaction chemistry and we've got a

379
00:12:33,819 --> 00:12:32,329
search strategy for you so what I've

380
00:12:36,639 --> 00:12:33,829
been saying for about six months now is

381
00:12:37,990 --> 00:12:36,649
seek and you shall find some rings so

382
00:12:39,910 --> 00:12:38,000
thank you there's nothing here that

383
00:12:41,319 --> 00:12:39,920
sacred take all the pictures you want