
AbSciCon
2019

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

2
00:00:11,859 --> 00:00:09,240
[Applause]

3
00:00:13,390 --> 00:00:11,869
I'm Zach I'm from Georgia Tech graduate

4
00:00:15,249 --> 00:00:13,400
student thereunder Amanda Stockton and

5
00:00:17,350 --> 00:00:15,259
today I'm going over some of the more

6
00:00:19,359 --> 00:00:17,360
recent data that I've gathered during my

7
00:00:21,429 --> 00:00:19,369
graduate career using a system that I

8
00:00:23,470 --> 00:00:21,439
built during the early stages using a

9
00:00:25,569 --> 00:00:23,480
technology called he said micro

10
00:00:27,280 --> 00:00:25,579
capillary electrophoresis with laser

11
00:00:28,990 --> 00:00:27,290
induced fluorescence and all that is is

12
00:00:31,359 --> 00:00:29,000
a separation detection technique for

13
00:00:33,280 --> 00:00:31,369

organic molecules and specifically we

14
00:00:40,240 --> 00:00:33,290
tested it using a series of Europa

15
00:00:41,739 --> 00:00:40,250
analogs so to get into it maybe not I

16
00:00:43,869 --> 00:00:41,749
always like to show this slide because

17
00:00:46,149 --> 00:00:43,879
I'm sure you've all seen it especially

18
00:00:49,270 --> 00:00:46,159
in the opening plenary on Monday but it

19
00:00:50,770 --> 00:00:49,280
really puts into perspective how

20
00:00:52,840 --> 00:00:50,780
challenging it can be to get to some of

21
00:00:55,360 --> 00:00:52,850
these outer solar system locations like

22
00:00:57,689 --> 00:00:55,370
like or Saturn I guess this would be

23
00:01:01,419 --> 00:00:57,699
Enceladus but Europa for for my case

24
00:01:04,149 --> 00:01:01,429
because it really shows how small energy

25
00:01:05,770 --> 00:01:04,159
efficient and automated your equipment

26
00:01:08,140 --> 00:01:05,780
needs to be and if you're running and

27
00:01:10,360 --> 00:01:08,150
eat any chemical analysis systems they

28
00:01:13,870 --> 00:01:10,370
need to be low volume simple high-speed

29
00:01:15,850 --> 00:01:13,880
and highly sensitive and one such piece

30
00:01:18,490 --> 00:01:15,860
of equipment that actually fits this

31
00:01:21,850 --> 00:01:18,500
profile our micro fabricated bio

32
00:01:25,300 --> 00:01:21,860
analysis systems and specifically one

33
00:01:27,940 --> 00:01:25,310
example of this type of system is our

34
00:01:30,610 --> 00:01:27,950
system the Mars organic inner analyzer

35
00:01:32,170 --> 00:01:30,620
prototype and it was built in prototypes

36
00:01:33,700 --> 00:01:32,180
and Mars analog environments and my

37
00:01:35,920 --> 00:01:33,710
advisor my adviser was involved in this

38
00:01:38,790 --> 00:01:35,930

research under rich Matthews at UC

39
00:01:41,380 --> 00:01:38,800
Berkeley and they tested it in multiple

40
00:01:43,860 --> 00:01:41,390
Mars analog environments like the Rio

41
00:01:48,400 --> 00:01:43,870
Tinto for music amino acids in Spain and

42
00:01:49,840 --> 00:01:48,410
found LEDs of 75 and 70 feet qumola for

43
00:01:52,000 --> 00:01:49,850
aldehydes and ketones at the Mojave

44
00:01:54,370 --> 00:01:52,010
Desert and they went ahead and continued

45
00:01:55,960 --> 00:01:54,380
analyzing it in multiple other Mars and

46
00:01:58,090 --> 00:01:55,970
Mars analog environments like bumpass

47
00:02:00,310 --> 00:01:58,100
Helen Atacama Desert for other other

48
00:02:01,960 --> 00:02:00,320
different types of organic acids for

49
00:02:03,730 --> 00:02:01,970
this talk I'm specifically focusing on

50
00:02:07,360 --> 00:02:03,740
amusing amino acids for characterizing

51
00:02:09,490 --> 00:02:07,370
my system and not in a Mars environment

52
00:02:11,410 --> 00:02:09,500
but a European environment and I think

53
00:02:14,440 --> 00:02:11,420
all of you know probably at this point

54
00:02:15,850 --> 00:02:14,450
why Europe is so important and it's in

55
00:02:17,680 --> 00:02:15,860
general there's a lot of water there and

56
00:02:19,930 --> 00:02:17,690
we're trying to get towards the more

57
00:02:22,870 --> 00:02:19,940
subsurface water or at least some of

58
00:02:25,060 --> 00:02:22,880
these cracks on the surface because on

59
00:02:27,400 --> 00:02:25,070
we see that our oceans are just teeming

60
00:02:28,750 --> 00:02:27,410
with life particularly down on the and

61
00:02:31,300 --> 00:02:28,760
the bottom there's the hydrothermal

62
00:02:33,310 --> 00:02:31,310
vents so this is a really great target

63
00:02:36,460 --> 00:02:33,320

when looking for organic bio MOC mark

64
00:02:39,310 --> 00:02:36,470
biomarker molecules so to get into the

65
00:02:42,370 --> 00:02:39,320
technique itself uses we use a micro

66
00:02:44,410 --> 00:02:42,380
device a pretty simple design here with

67
00:02:46,420 --> 00:02:44,420
a t cross channel so you can generate an

68
00:02:48,550 --> 00:02:46,430
injection and a plug right at the the

69
00:02:49,990 --> 00:02:48,560
junction and then send it down your

70
00:02:53,440 --> 00:02:50,000
separation channel with some patterned

71
00:02:55,000 --> 00:02:53,450
new channel bends to generate an

72
00:02:56,200 --> 00:02:55,010
effective separation distance of six

73
00:02:57,490 --> 00:02:56,210
point seven centimeter so it's a very

74
00:02:59,560 --> 00:02:57,500
small platform for running these

75
00:03:03,700 --> 00:02:59,570
analyses with this particular with this

76
00:03:05,470 --> 00:03:03,710
microwaves and to briefly explain how

77
00:03:06,820 --> 00:03:05,480
that phenomena works if you were here

78
00:03:09,970 --> 00:03:06,830
for PETA Willis's talked he went over

79
00:03:12,370 --> 00:03:09,980
this but to briefly go over it in that

80
00:03:13,930 --> 00:03:12,380
capillary you have a stack layer of

81
00:03:16,660 --> 00:03:13,940
positive charges using your analyte and

82
00:03:18,760 --> 00:03:16,670
when you apply voltage to it you

83
00:03:20,490 --> 00:03:18,770
generate a current down that capillary

84
00:03:22,630 --> 00:03:20,500
and you can actually separate out

85
00:03:26,320 --> 00:03:22,640
positive negative and neutral charged

86
00:03:28,480 --> 00:03:26,330
species using combined EF and electro

87
00:03:31,300 --> 00:03:28,490
phoretic flow and you can take advantage

88
00:03:34,480 --> 00:03:31,310

of this fact by generating an injection

89
00:03:36,010 --> 00:03:34,490
at your T channel your junction by

90
00:03:38,140 --> 00:03:36,020
inducing this current down from your

91
00:03:40,270 --> 00:03:38,150
sample to your waist and then shifting

92
00:03:41,680 --> 00:03:40,280
your your currents so that you pull back

93
00:03:44,560 --> 00:03:41,690
towards your waist and your sample and

94
00:03:45,970 --> 00:03:44,570
start moving your analytes and molecules

95
00:03:49,960 --> 00:03:45,980
that you're looking at down towards your

96
00:03:52,000 --> 00:03:49,970
detector so now moving towards the

97
00:03:53,560 --> 00:03:52,010
detection technique form using the

98
00:03:55,570 --> 00:03:53,570
masses like I said what we're dealing

99
00:03:56,980 --> 00:03:55,580
with there for the ones we were looking

100
00:03:59,350 --> 00:03:56,990
at they're not neatly fluorescent so we

101
00:04:01,780 --> 00:03:59,360
need to detach fluorescent probe and we

102
00:04:03,430 --> 00:04:01,790
use specific blue Cecina molestor that's

103
00:04:04,660 --> 00:04:03,440
been shown to work very efficiently for

104
00:04:07,060 --> 00:04:04,670
the means and we know acids using

105
00:04:09,520 --> 00:04:07,070
systems like this at buffer pH of nine

106
00:04:11,170 --> 00:04:09,530
and it's very simple reactions very fast

107
00:04:15,370 --> 00:04:11,180
takes about 15 minutes go to nearly

108
00:04:18,370 --> 00:04:15,380
completion and so we like to use it as

109
00:04:20,620 --> 00:04:18,380
our our lab standard form using amino

110
00:04:22,960 --> 00:04:20,630
acids so you can imagine like I just

111
00:04:25,390 --> 00:04:22,970
showed here you have your detector here

112
00:04:27,550 --> 00:04:25,400
as it's going down this column it

113
00:04:29,110 --> 00:04:27,560

reaches your micro device which is this

114
00:04:32,320 --> 00:04:29,120
tiny little dot here that's your channel

115
00:04:34,210 --> 00:04:32,330
and when you're shining a laser on it it

116
00:04:36,100 --> 00:04:34,220
generates the fluorescent signal which

117
00:04:36,610 --> 00:04:36,110
is captured by your system and so

118
00:04:39,130 --> 00:04:36,620
briefly

119
00:04:41,800 --> 00:04:39,140
design of the system we have a laser

120
00:04:44,230 --> 00:04:41,810
here at 405 nanometers which is

121
00:04:46,390 --> 00:04:44,240
excitable for Pacific Blue cinema

122
00:04:48,430 --> 00:04:46,400
arrestor going through a long pass

123
00:04:50,530 --> 00:04:48,440
filter through a dichroic mirror into

124
00:04:52,660 --> 00:04:50,540
jeff objective lens which focuses it

125
00:04:54,130 --> 00:04:52,670
onto your micronized Channel and then

126
00:04:56,350 --> 00:04:54,140
you can capture the fluorescence back

127
00:04:58,860 --> 00:04:56,360
through your objective lens down through

128
00:05:01,690 --> 00:04:58,870
your dichroic through a long pass filter

129
00:05:03,940 --> 00:05:01,700
through a spatial filter off of a mirror

130
00:05:05,710 --> 00:05:03,950
into a focusing lens and then eventually

131
00:05:09,670 --> 00:05:05,720
into your detector and for our case we

132
00:05:11,590 --> 00:05:09,680
use a spectrometer and so you put that

133
00:05:15,370 --> 00:05:11,600
into a picture to show what all these

134
00:05:17,860 --> 00:05:15,380
components are we have our 3d stage

135
00:05:19,630 --> 00:05:17,870
which allows us to its differs from most

136
00:05:21,880 --> 00:05:19,640
breadboard systems where you physically

137
00:05:23,290 --> 00:05:21,890
mount all of your your lasers and your

138
00:05:25,960 --> 00:05:23,300

equipment on to the breadboard itself

139
00:05:28,900 --> 00:05:25,970
down here I did a 33 millimeter cute

140
00:05:34,240 --> 00:05:28,910
cage cube system inspired from Erin Noel

141
00:05:36,370 --> 00:05:34,250
at JPL and so we are actually able to

142
00:05:38,050 --> 00:05:36,380
move our entire optical assembly

143
00:05:40,750 --> 00:05:38,060
wherever we wanted to go to align it to

144
00:05:41,650 --> 00:05:40,760
our micro guys stage at the top and to

145
00:05:44,200 --> 00:05:41,660
point out some of the major components

146
00:05:46,690 --> 00:05:44,210
again with our laser and all of our

147
00:05:48,910 --> 00:05:46,700
mirrors and filters to our objective

148
00:05:51,810 --> 00:05:48,920
lens and bringing down our fluorescence

149
00:05:54,670 --> 00:05:51,820
signal back to a fiber to our detector

150
00:05:56,860 --> 00:05:54,680
so we characterize this system using a

151
00:05:58,840 --> 00:05:56,870
set of standards and buffer

152
00:06:00,790 --> 00:05:58,850
concentrations so first we want to take

153
00:06:02,440 --> 00:06:00,800
a look at the effect of buffer

154
00:06:04,360 --> 00:06:02,450
concentration using our specific micro

155
00:06:06,850 --> 00:06:04,370
device and we did a series of

156
00:06:09,130 --> 00:06:06,860
concentrations and found that 35 normal

157
00:06:12,040 --> 00:06:09,140
was ideal for running our separations

158
00:06:13,780 --> 00:06:12,050
before Joule heating occurred and Joule

159
00:06:15,280 --> 00:06:13,790
heating really will it will generate

160
00:06:17,020 --> 00:06:15,290
bubbles in your channel and it will

161
00:06:18,700 --> 00:06:17,030
affect your separation significantly so

162
00:06:19,960 --> 00:06:18,710
to be safe we went with 35 millimolar

163
00:06:22,960 --> 00:06:19,970

board buffer for our continued

164
00:06:25,360 --> 00:06:22,970
experiments we ran LEDs of alanine and

165
00:06:29,350 --> 00:06:25,370
glycine and found the LOD of our system

166
00:06:31,090 --> 00:06:29,360
to be 2.2 and/or 2.2 and 2.91 for Elleni

167
00:06:33,880 --> 00:06:31,100
and glycine respectively which is on par

168
00:06:38,560 --> 00:06:33,890
with other systems with spectrometers at

169
00:06:40,600 --> 00:06:38,570
detector so to get back to Europa we

170
00:06:44,250 --> 00:06:40,610
were we then needed to characterize our

171
00:06:46,750 --> 00:06:44,260
system for Europa analogues not just

172
00:06:48,370 --> 00:06:46,760
basic lab standards and we know that

173
00:06:50,379 --> 00:06:48,380
Europa has magnesium sulfate sodium

174
00:06:51,820 --> 00:06:50,389
carbonate so we

175
00:06:53,920 --> 00:06:51,830
we were taking we took a look at those

176
00:06:56,499 --> 00:06:53,930
and we also wanted to take at some more

177
00:06:57,939 --> 00:06:56,509
more benign situation with carbonic acid

178
00:07:00,429 --> 00:06:57,949
in a more extreme situation with

179
00:07:03,670 --> 00:07:00,439
sulfuric acid to analyze the effects of

180
00:07:06,159 --> 00:07:03,680
pH so to start off we have our

181
00:07:08,559 --> 00:07:06,169
separations of carbonic acid so what we

182
00:07:11,649 --> 00:07:08,569
have here as going down it's a decrease

183
00:07:14,129 --> 00:07:11,659
in concentration of your nasty stuff in

184
00:07:16,689 --> 00:07:14,139
solution so in this case carbonic acid

185
00:07:18,070 --> 00:07:16,699
starting at two nano molar which about

186
00:07:19,450 --> 00:07:18,080
as concentrated as it gets because it's

187
00:07:22,360 --> 00:07:19,460
pretty weak and it's hard to it's hard

188
00:07:24,399 --> 00:07:22,370

to get constant concentrated and this

189
00:07:26,890 --> 00:07:24,409
dilution up here represents a dilution

190
00:07:29,890 --> 00:07:26,900
before reaction so you imagine you have

191
00:07:32,290 --> 00:07:29,900
this 2 mm animal or solution of carbonic

192
00:07:35,050 --> 00:07:32,300
acid diluted one to one so it's actually

193
00:07:38,080 --> 00:07:35,060
one thousand animal ER and what we see

194
00:07:39,700 --> 00:07:38,090
here is that no concentration not even

195
00:07:43,719 --> 00:07:39,710
the high ones affect our separation and

196
00:07:45,790 --> 00:07:43,729
basically we can generate every every

197
00:07:48,550 --> 00:07:45,800
reaction and every separation is exactly

198
00:07:50,769 --> 00:07:48,560
what we were expecting so weak acids

199
00:07:53,920 --> 00:07:50,779
don't have an effect on our CZE

200
00:07:56,200 --> 00:07:53,930
separations so we moved on to sodium

201
00:07:57,369 --> 00:07:56,210
carbonate Europe analogues and we

202
00:07:59,200 --> 00:07:57,379
started to see as some of the higher

203
00:08:00,610 --> 00:07:59,210
concentrations and so this is the same

204
00:08:03,040 --> 00:08:00,620
experiment just done with a different

205
00:08:04,990 --> 00:08:03,050
analyte here and the some of the higher

206
00:08:08,290 --> 00:08:05,000
concentrations started to show effects

207
00:08:10,180 --> 00:08:08,300
in our separation so we went ahead and

208
00:08:12,490 --> 00:08:10,190
diluted them further so what these show

209
00:08:14,320 --> 00:08:12,500
the fluorescence intensity is along this

210
00:08:16,600 --> 00:08:14,330
axis are scaled relative to each other

211
00:08:17,800 --> 00:08:16,610
so this is a one to one this is one to

212
00:08:21,010 --> 00:08:17,810
ten dilution these fluorescence

213
00:08:22,629 --> 00:08:21,020

intensities are scaled one to ten so

214
00:08:25,390 --> 00:08:22,639
that's why it seems a little more noisy

215
00:08:27,610 --> 00:08:25,400
here but what we see here as we as we

216
00:08:29,619 --> 00:08:27,620
begin to dilute our solution and dilute

217
00:08:32,139 --> 00:08:29,629
our sample or analog sample before

218
00:08:33,430 --> 00:08:32,149
analysis or before our reaction we begin

219
00:08:35,139 --> 00:08:33,440
to start seeing our Peaks even at the

220
00:08:37,240 --> 00:08:35,149
higher concentration sample so they're

221
00:08:39,490 --> 00:08:37,250
actually our organics in there you just

222
00:08:40,719 --> 00:08:39,500
need to dilute it beforehand because

223
00:08:42,519 --> 00:08:40,729
you're having effects from sodium

224
00:08:44,079 --> 00:08:42,529
concentration in your solution creating

225
00:08:47,710 --> 00:08:44,089
iearnt dispersion defects affecting your

226
00:08:49,269 --> 00:08:47,720
injection moving on we want to take a

227
00:08:51,910 --> 00:08:49,279
look at sulfuric acid so this is an

228
00:08:55,000 --> 00:08:51,920
extreme acid case and so we were seeing

229
00:08:55,840 --> 00:08:55,010
that our in fact we were basically at

230
00:08:58,090 --> 00:08:55,850
the really even at the low

231
00:08:59,980 --> 00:08:58,100
concentrations it was affecting our

232
00:09:02,680 --> 00:08:59,990
injections or our separation or

233
00:09:03,670 --> 00:09:02,690
reactions and so we started doing more

234
00:09:10,060 --> 00:09:03,680
delusions

235
00:09:11,829 --> 00:09:10,070
1 to 10 and and 1 to 2 started making a

236
00:09:16,120 --> 00:09:11,839
little better and 1 to 10 really was

237
00:09:18,820 --> 00:09:16,130
more ideal and in contrast to the sodium

238
00:09:20,680 --> 00:09:18,830

which was affecting our separations due

239
00:09:22,960 --> 00:09:20,690
to an aversion effects this was

240
00:09:23,560 --> 00:09:22,970
affecting our reaction because as I

241
00:09:26,410 --> 00:09:23,570
alluded to

242
00:09:29,110 --> 00:09:26,420
because reaction with Pacific blue and

243
00:09:30,699 --> 00:09:29,120
organics is pH dependent so the high

244
00:09:33,430 --> 00:09:30,709
concentration of sulfuric acid with

245
00:09:36,250 --> 00:09:33,440
creating a low pH in your analog sample

246
00:09:39,250 --> 00:09:36,260
which was not allowing your reaction to

247
00:09:41,050 --> 00:09:39,260
occur moving on from that we took a look

248
00:09:45,220 --> 00:09:41,060
at magnesium sulfate Europe analogues

249
00:09:48,639 --> 00:09:45,230
and we're basically this was a

250
00:09:50,829 --> 00:09:48,649
worst-case scenario but you can affect

251
00:09:52,810 --> 00:09:50,839
you can fix the effects the deleterious

252
00:09:55,449 --> 00:09:52,820
effects of magnesium sulfate which is

253
00:09:58,510 --> 00:09:55,459
affecting your injection by adding in

254
00:10:02,110 --> 00:09:58,520
EDTA to sequester any metal cations that

255
00:10:03,810 --> 00:10:02,120
it can calculate and just bring back all

256
00:10:06,670 --> 00:10:03,820
of your separations inorganic Peaks

257
00:10:09,280 --> 00:10:06,680
immediately up to about double the

258
00:10:13,870 --> 00:10:09,290
concentration of EDTA in there which is

259
00:10:17,710 --> 00:10:13,880
about 5 millimolar so to summarize it

260
00:10:20,050 --> 00:10:17,720
down there moving on we analyzed a earth

261
00:10:21,310 --> 00:10:20,060
analog sample provided by Kate craft one

262
00:10:24,790 --> 00:10:21,320
of our collaborators at Johns Hopkins

263
00:10:28,150 --> 00:10:24,800

Applied Physics Laboratory and we know

264
00:10:30,090 --> 00:10:28,160
here that this guys are at the champagne

265
00:10:32,110 --> 00:10:30,100
geyser at chef Anne ranch in Utah

266
00:10:35,410 --> 00:10:32,120
actually has carbonates and sodium

267
00:10:37,000 --> 00:10:35,420
chlorides and it has high ejection

268
00:10:39,940 --> 00:10:37,010
pressures and a legates to blue injector

269
00:10:42,130 --> 00:10:39,950
or subsurface ocean pressures so we went

270
00:10:44,829 --> 00:10:42,140
ahead and analyzed sample here and what

271
00:10:47,470 --> 00:10:44,839
we saw is that we ran a 1 to 40 dilution

272
00:10:49,630 --> 00:10:47,480
of the sample and we spiked for our

273
00:10:51,430 --> 00:10:49,640
other series of organic acids leucine

274
00:10:55,030 --> 00:10:51,440
valine C R now in angle I seems we've

275
00:10:56,980 --> 00:10:55,040
done before and we saw nearly all of

276
00:10:59,560 --> 00:10:56,990
them except for the two acids in the

277
00:11:01,180 --> 00:10:59,570
sample so if you take a look from the

278
00:11:02,410 --> 00:11:01,190
bottom up we run our standard just to

279
00:11:04,660 --> 00:11:02,420
compare to every time so we know our

280
00:11:07,300 --> 00:11:04,670
separations are working really well and

281
00:11:08,860 --> 00:11:07,310
then we run a blank just to see what no

282
00:11:10,030 --> 00:11:08,870
signal would look like it's really hard

283
00:11:11,380 --> 00:11:10,040
to get a line you know you know it's

284
00:11:12,730 --> 00:11:11,390
earth there's a lot of life here it's

285
00:11:14,350 --> 00:11:12,740
hard to get rid of all the organics even

286
00:11:16,130 --> 00:11:14,360
if you ten times distill your water 50

287
00:11:19,610 --> 00:11:16,140
times to still your water

288
00:11:21,650 --> 00:11:19,620

so taking a look at the sample itself we

289
00:11:23,300 --> 00:11:21,660
clearly can see alanine there's tons of

290
00:11:24,710 --> 00:11:23,310
alanine everywhere as we would expect so

291
00:11:26,600 --> 00:11:24,720
we can't get out of our blank but we

292
00:11:28,100 --> 00:11:26,610
also spike in and can see our leucine

293
00:11:30,530 --> 00:11:28,110
valine serine and glycine and then of

294
00:11:33,080 --> 00:11:30,540
various other organics that we have yet

295
00:11:34,430 --> 00:11:33,090
to identify but we have other standards

296
00:11:39,050 --> 00:11:34,440
that have been done before we can

297
00:11:40,730 --> 00:11:39,060
compare to and our spike sample we can

298
00:11:42,380 --> 00:11:40,740
quantify some of these organics using

299
00:11:43,790 --> 00:11:42,390
spiked standards and in fact we

300
00:11:46,790 --> 00:11:43,800
quantified alanine and glycine into

301
00:11:48,380 --> 00:11:46,800
fairly high concentrations so 875 an

302
00:11:50,930 --> 00:11:48,390
animal was for glycine and 80 point 1

303
00:11:52,850 --> 00:11:50,940
micromolar for alanine

304
00:11:54,560 --> 00:11:52,860
so that concludes some of the work we

305
00:11:55,550 --> 00:11:54,570
did for our Europe analogs I just want

306
00:11:58,490 --> 00:11:55,560
to summarize some of the major

307
00:12:00,710 --> 00:11:58,500
accomplishments of the project so first

308
00:12:02,390 --> 00:12:00,720
and foremost we have a 2.1 animal lunar

309
00:12:04,220 --> 00:12:02,400
detection for a benchtop system and as i

310
00:12:06,380 --> 00:12:04,230
said that's very that's analogous to

311
00:12:09,080 --> 00:12:06,390
other similar systems built with a

312
00:12:10,880 --> 00:12:09,090
spectrometer as detector we have

313
00:12:12,680 --> 00:12:10,890

successful separation series of sulfuric

314
00:12:14,360 --> 00:12:12,690
acid carbonic acid and carbonate and

315
00:12:16,010 --> 00:12:14,370
magnesium sulfate Europa analogues to

316
00:12:17,600 --> 00:12:16,020
demonstrate the robustness of our

317
00:12:20,510 --> 00:12:17,610
technique towards these types of

318
00:12:22,820 --> 00:12:20,520
environments and we detected organics in

319
00:12:25,550 --> 00:12:22,830
a Utah geyser sample analogous to that

320
00:12:27,080 --> 00:12:25,560
of a Europe analog our future work I

321
00:12:29,780 --> 00:12:27,090
hope to do is to run some automated

322
00:12:32,540 --> 00:12:29,790
processes of these analysis using a

323
00:12:34,580 --> 00:12:32,550
microfluidic processor and as well it's

324
00:12:36,860 --> 00:12:34,590
not listed up here I would like to start

325
00:12:40,070 --> 00:12:36,870
building more miniaturize system of this

326
00:12:41,330 --> 00:12:40,080
type of micro cels system and actually

327
00:12:42,470 --> 00:12:41,340
do you have the components in lab so I

328
00:12:43,670 --> 00:12:42,480
just started building it right before

329
00:12:43,940 --> 00:12:43,680
coming here I'm pretty excited about

330
00:12:48,290 --> 00:12:43,950
that

331
00:12:50,960 --> 00:12:48,300
I should be able to drop the limited

332
00:12:52,790 --> 00:12:50,970
section from nanomolar to picomolar at

333
00:12:56,900 --> 00:12:52,800
least one order of magnitudes from our

334
00:12:59,270 --> 00:12:56,910
preliminary experiments and of course I

335
00:13:01,220 --> 00:12:59,280
need to show of my acknowledgments here

336
00:13:03,350 --> 00:13:01,230
so I have so many collaborators

337
00:13:04,610 --> 00:13:03,360
everywhere them so fortunate to have so

338
00:13:07,040 --> 00:13:04,620

I just want to point out all of them

339
00:13:08,270 --> 00:13:07,050
here at space sciences laboratory that

340
00:13:11,780 --> 00:13:08,280
I've been working with for a few years

341
00:13:13,820 --> 00:13:11,790
on an sells organic analyzer project JPL

342
00:13:15,290 --> 00:13:13,830
a lot of people here were provided some

343
00:13:17,900 --> 00:13:15,300
of the initial insight for the project

344
00:13:19,580 --> 00:13:17,910
four years ago Chris Berkeley Richard

345
00:13:21,080 --> 00:13:19,590
Matthews and mutton gülizar which I

346
00:13:23,150 --> 00:13:21,090
worked with out there

347
00:13:25,820 --> 00:13:23,160
Kate Kraft were providing sample and her

348
00:13:28,010 --> 00:13:25,830
irad team at Johns Hopkins and my

349
00:13:29,510 --> 00:13:28,020
funding sources NASA Georgia Tech NSF

350
00:13:31,520 --> 00:13:29,520
and the center for Kevlar came

351
00:13:33,320 --> 00:13:31,530
evolution and I just wanted to point out

352
00:13:35,180 --> 00:13:33,330
that my advisor has a talk tomorrow if