

Wyatt Clip 1

[00:02:51.04]

I: So I guess, speaking of research, can you tell me a little bit about your research in 299B?

W: Ah, my research with [Mentor 1] and [Mentor 2], it was really cool and pertaining with um, Supermassive Black Holes. It was pretty much like the attributes and characteristics of each object in the sky, each galaxy, and how those characteristics of those galaxies gave shape and I'd say, I don't wanna reuse the word characteristics, but um, it was pretty much like the uh, it gave identity to the black holes themselves and we used those characteristics in the kinda like, maybe, point us in the direction of finding an answer about why certain supermassive black holes give off their uh, their uh, jets. And so it was really fun. It was a lot of uh, really analytical. A lot less computational than I thought it would be, which was a godsend because my math isn't the strongest.

[00:03:57.20]

I: So what was fun about it? For you-

W: Umm, not so much the activity, it was a lot of data logging but it was fun actually seeing the raw data that these astronomers collect and then putting together, and making an analysis of that. And then putting all that data together, putting it in a presentation and then getting to tell people about it.

I: Cool, so you also enjoyed the presentation aspect of it.

W: Yeah, cause I mean when people hear like supermassive black holes they're like "Woah, man, that sounds crazy" and it's like "it's crazy but it's not that crazy... to do all the science"

[00:04:26.00]

I: So what, what is it like just like jumping into a research project like that?

W: Um, At first it was kind of, it was kinda hectic. Cause like, I don't know. You're always kinda intimidated at first when you get into research. Cause you're like, postdocs, and like, you don't wanna waste their time, and they work on big things and it's like oh, I'm just a freshman. But um, after awhile, it was, it was, it was pretty cool. I liked it a whole lot.

[00:04:55.22]

I: So do you feel like you're less intimidated by your research now?

W: Ah yeah definitely. Cause I don't know, there's always a place for anyone with a certain, like, skill level, cause I mean, the experts are always gonna be at the top. And wherever they need you, if they decide to choose you at all, that's probably where you're gonna have the best fit.

I: Mm, So do you feel like you've like, moved up in your fit? (gestures levels)

W: Uh yeah, a little bit actually. I mean, not just being a sophomore in college, as opposed to a freshman but like having the experience and you know like getting things done, presenting things. And even small things like using excel or various I don't know, (??) python kit. But, I feel, I feel, a little bit more proficient in research.

Wyatt Clip 2

[00:11:30.12]

I: It sounds like that was productive and your pairing with your mentors in 299B, but those are kinda like different like you being on the same level versus your mentors knowing a lot more than you. \W: Yeah\
Is there- I wonder if you could contrast and compare those.

W: Ahh. (inaudible) It's like, hmm, I don't know, when you're working with your peers it's almost like a no pressure situation. Cause even if you, like, even if you don't know anything about a particular subject, or, you're just not as strong skilled, you kinda have people that are like on that level that feel that way,

48 maybe not necessarily about the subject you're working on, but at least something in your lives,
49 whereas you're working with um like, someone whose been through everything, with a post-doc. It's
50 kinda like oh, man, I don't want to mess up, I gotta really impress these guys. But I mean, I guess if you
51 get the right postdoc they can reassure you, like 'Eh, it's cool' \I: (laughs)\ 'It's alright,' 'We know where
52 you're coming from.' And I don't know it's kinda like, you're just trying to impress a little bit more. Cause
53 I mean these dudes are in high positions but, at least for me, you still have the reassurance like hey if
54 this is wrong, they'll probably spot it, \I: Yeah\, they'll tell you what to do, how to correct it. Not just- \I:
55 Let you\ give you an F, or let you go, and embarrass yourself in front of a whole bunch of people.

56

57 [00:12:58.28]

58 I: (Laughs) Ok. Were there ways that your research experience was like, different than how you
59 expected?

60 W: Um, Yeah actually. When the uh, professors, well not professors, well the postdocs, well anyway,
61 when they went to go present the uh, research opportunities at first, I don't know um, on supermassive
62 black holes, I was like, man that's serious cosmology. That's probably a mess of math that I am nowhere
63 near prepared for. But I do like astronomy so much so, I was like man let me just go for it. And then
64 what I realized it's not so much like, raw theory. They actually do have like, telescopes, hardware that
65 take all these measurements, and you're just computing all that data. And like, actual like, analytical,
66 what's the word I'm looking for, I don't know- substance- and yeah I didn't, like I imagined like,
67 Cosmology being a whole lot more theory. Cause actually it's pretty concrete. It's actually like, real data
68 we're getting from these machines. And then, we churn out that data to have something you know,
69 readable, something understandable. And from that, that actually surprised me. And, it kinda changed
70 my view of uh, Cosmology cause the data's all this stuff we actually do know about these objects that
71 are so so far away.

72

73 [00:14:25.08]

74 I: Hm. Interesting. Yeah so like what do you think you would have done if it was math intensive? Like
75 jumping into that

76 W: Um, I would have tried my best. Cause honestly, even if you do something hard, and like, you're
77 failing the first few times, you are getting better. And I don't know I guess it's just my nature not to quit.
78 At least, not right away. So I probably would have chugged through it. More than likely. I mean I would
79 have been like a little bit, a little bummed out, on like doing something that hard. And then, you have
80 the grade in 299B and you have the presentation. So I mean, it'd be like a little bit of pressure, you know
81 make something substantial out of what you're doing.

82 Wyatt Clip 3

83 W: Especially with 299B, I mean, there's no harm in asking your research professor, 'what's this?' Cause,
84 I mean especially if you are like a - I don't know how many of you are freshmen, but if you are a
85 freshman physics student, there is a by definition three years of things you don't know - and especially if
86 you're working with anyone in astronomy, there's X amount of things you don't know cause you're not
87 even in that major. Which was for me, and there's like variables and equations, that I was like "Ahh-- you
88 gotta explain it" but, chances are if they sign on for this class, they're cool enough to explain to you,
89 what exactly you're supposed to be doing for the next month or two.

90

91 A: Well- Like, The thing to remember is that when it comes to professors, they all know, they want you
92 to know that they know, they want you to learn, but in research, they don't know either, you know what
93 I mean? You're doing research because they don't know the answer to these things, and you're kinda on
94 the same footing and it's important ot remember that. \ (Wyatt nodd)\ Like you're both asking the

95 same questions. You and your mentor are both asking the same question. So like, don't feel just because
96 you don't have all the tools just to figure the answer out, that like, you're not on the same plane in the
97 process. Cause --
98 |A: That's the whole point.
99 |W: I definitely agree with that.
100 W: And it's cool like you'll have data, and you'll have like your professors really like, thinking about it,
101 puttin' it in perspective, and it's like "oh man," kinda on the same footing but not really, but still kinda.
102

103 Acton Clip 1

104 [00:05:43.01]

105 I: So, can you tell me a little bit about your research experience in 299B?

106 A: Yeah, um, so, I worked in the Center for Nanophysics and Advanced Materials. And um, we studied
107 Topological Insulators, um, It was very um, different from what I expected. Just because it was very
108 hands on and um, most of it was like, preparing the experiment and like actually running the
109 experiment, as opposed to like data analysis and stuff, which I liked, I thought it was really interesting,
110 yeah it was just, it was different from what I expected. But um.

111 Yeah, so like do you want me to like, describe what we did or-?

112 I: Uh, I guess, can you say a little more about what you thought it would be like before you started?

113 A: Yeah well I thought it would be like, I don't know, we'd just like have some experiment already set up
114 and we run some machine that does all this stuff that I wouldn't even understand, and then we'd just
115 get all this data and we'd have to like, you know, analyze the data. And like find patterns and stuff, but,
116 most of it was actually us setting up the experiment and um, because yeah. We were working with these
117 materials, the topological insulators, and like we, we had to make our own, so that took awhile, and
118 then, you have to like wire up the samples, and that took awhile, and then finally you'd put em in the
119 machine, and but that-that was at the very end, that was like a small amount of our total time um, but
120 yeah it was very interesting.

121

122 [00:07:24.07]

123 I: So, what was it like getting started? Like jumping in to a lab?

124 A: Um, well, it was pretty, it was a pretty um-, it wasn't as difficult as I thought it was gonna be. I wasn't
125 sure, because going into it, I tried to like read up into what we were studying a little bit, and it was way
126 over my head. I was like this is like, way in the future for me. But getting in there like uh, you know they
127 gave us a tour of like, everything in the lab, and um, they showed us how stuff worked and a lot of the
128 first few weeks we weren't actually doing anything, it was just trying to get down some of the
129 techniques that we needed. Um, like we had to like, learn to use the blow torch and make like the right
130 size, like, tubes and how to wire up samples under a microscope and stuff like that. Um. So yeah it
131 wasn't- by the time we actually got to needing to use these things, we were pretty well prepared. And
132 then in terms of understanding exactly what we were doing, it was a lot of like, it was a lot of trying to
133 research that. Like I had to do a lot of research, like, on my own, and read about it a lot. And um, I mean
134 to prepare we had, like, I don't know, 15 or so wikipedia pages or something that you just have to read

135 up on. Which were useful. And um, And then we had a few days where we just sat down and he would
136 lecture um, about just like certain topics that we needed to know to like, understand what was
137 happening. And in the end, I actually - I think we - I had a pretty good understanding of what was going
138 on. Even though it was a little bit far advanced in terms of what classes I took, but I think I had a fairly
139 good understanding of what we were doing. Which was good, so, yeah. Definitely learned a lot more
140 than I thought I was going to in terms of like, actual like physics knowledge. Yeah.

141 Acton Clip 2

142 [00:20:58.24]

143 I: So are there times where you felt like creativity was particularly helpful for you or you saw someone in
144 research doing something where creativity was necessary?

145 A: Well um, like um, like Savannah and I coming into this experiment. It was uh, it was interesting
146 because they were like, their whole group, they had done this before, like the experiment they were
147 doing. They had done it before, like many times, so there were like, like, little like, they seemed like little
148 things. but they end up having a big impact, where like, he would tell us to do something a certain way,
149 and we'd be like 'oh, why do you do it like that' and he's like 'oh, we've done it like this before, and this
150 happened so we decided to change it to do it this way, we prevented this problem from happening.'
151 Stuff like that, we saw it like when they were introducing us to like how to run the experiment, just little
152 changes they made that were uh, just a result of them saying okay, we have our experiment, like, how
153 do you think we can make this better? Um, and yeah they just found like little things but in the end it
154 makes a big difference. Uh, you know, especially when you're like measuring things on such small scale.
155 The smallest change can get rid of a lot of error and a lot of uncertainty. So I thought that that was
156 pretty interesting, that was definitely, took a lot of creativity to try and like improve on what they
157 already had, cause I think that's definitely when creativity comes most into play, cause when you have
158 something that already works, but then you kinda take a step back, you're like okay can we make this
159 work better? Um, cause that's kinda hard to do cause once it works, you don't wanna-

160 I: You dont want to mess it up?

161 A: Exactly. You don't want to mess it up, you don't want to change something that's not broken. Um, but
162 you know, I think in some cases it can definitely be helpful.

163 [00:22:58.23]

164 I: Okay, so what were some of the - what were the most positive times for you in your research?

165 A: Um, I actually um, I really enjoyed putting together the paper at the end. I don't know it was very
166 satisfying.

167 I: What was satisfying about it?

168 A: Yeah it was nice because like, In the end I had you know like, all this data, I had all these graphs, I had
169 all these pictures, and I was able to just like, it was really easy to write because I was able to like- Writing
170 the paper I knew exactly what I was talking about. I knew exactly what to write about. And I had these
171 results, and I was like, okay well six weeks ago I had no idea what this means but, now I can describe
172 these and I know exactly what's happening. Um, so that was nice. And along with that also like

173 presenting the research at the research fair. That was pretty cool too. Putting the poster together and all
174 that.

175 But yeah that was the most satisfying part - just like seeing the data at the end.

176 I also, I also like enjoyed seeing some of the- like actually like, like getting our sample all prepared and
177 stuff, like wiring up the samples, and then sticking it in a machine, that was, that was pretty fun. It's nice
178 to see like, you're actually like, doing science. Like. You're not just writing about it. Like, you're not just
179 solving imaginary problems that your teacher made up, uhh, you're actually like doing something and
180 getting results, so that's pretty cool.

181 [00:24:51.28]

182 I: So, what does doing science mean to you?

183 A: I guess like, in general or just like specific to my research project or?

184 I: I guess, yeah, maybe a little bit of both, since you feel like your research was doing science.

185 A: Okay well um, I guess like- doing science like in my research project, that was just like, like preparing
186 this whole sample over the span of like, weeks. And then being able to like, put it in the machine, and be
187 like okay here's all the data we got, um, so like the actual like, I guess the actual like hands on part of it
188 was like what I think of. And like actually, I feel like um, like doing science is more of like, it's not so, it's
189 not so clear cut, like you're kind of doing something maybe like, something weird. Maybe it hasn't been
190 done, maybe it has been done, but it's like weird to you. Like. You don't really know what to expect, but
191 that's kinda the fun part because you get the results, and you see what happens, like okay, like, this is
192 what happened, like, this is you know, this is what's happening, so I don't know I guess like the
193 uncertainty of it. And the actual like, the more like, umm, hands on stuff. I think that's more of like,
194 doing science to me.

195 [00:26:38.01]

196 I: Hm, so are there things you felt like you learned about doing science through doing this research?

197 A: Um yeah, I mean, I definitely, I learned more just about like, how exactly research gets done and like
198 the lab environment. Um, cause it's very interesting especially like working down here because there
199 were a lot of different groups that shared the same lab. And um, so there's a lot of like, I don't know like,
200 protocol, I guess, or like ettiquette, I don't know. Just working with a bunch of different people. Umm.
201 Yeah, so that was interesting, that was like one thing I learned about research that I didn't really know
202 before.

203 And um, also like uh, it was like, I'm trying to remember, yeah and I guess another thing I learned about
204 research is that it's, I guess, I don't know if it's specific for just this research project, but I feel it's
205 probably for other ones too, is that uh, the most important part was like preparing like, preparing the
206 experiment and then the data analysis was just like, Ok let's take a look at it and see if it makes sense.
207 But um, yeah like there was a real like, the real emphasis was on the actual experiment. Um, you know
208 like, designing that and like using your knowledge of physics to design the best experiment for
209 measuring a certain like, a certain like uh, quantity about some material. So yeah that's, that's probably
210 what I learned most about like actually doing science and the research like, part of it, It's all about the

211 experiment, it's all about like, how you measure something as opposed to like what you're actually
212 measuring.

213

214 [00:28:46.01]

215 Í: So, why would you say it's important to have a really well-designed experiment?

216 A: Um, well I guess from, I mean like uh, one reason why it's like most obviously important is you don't
217 want a lot of error. You want your results to actually mean something. That's pretty important. But it's
218 also like, there are, I feel like depending on what you're researching, but I feel like for my specific
219 research project, there were probably a few different ways we could have like, measured like uh, what
220 we measured, and um. I think the way you go about measuring that is important because you want, you
221 want to try and like, isolate off as many like, like other variables as possible. You just want to focus on
222 like one thing, and that, you can't, you can't just like, tell a machine, like okay just measure this one
223 thing and nothing else. Like, you know. You'll get like variations from other stuff, so, in order to get the
224 one thing you want, that's like that's where the experimental design comes in. You wanna try and think
225 of creative ways of like okay, like, we can eliminate this source of error if we do this when we measure
226 it. Stuff like that, um, which again ties to what I was saying on how, like, they have these little tweaks to
227 experiment and preparing the experiment. Which kind of, in the end, they were like okay, well, if we do
228 it this way, then it'll get rid of all this other random stuff we don't want so then we'll get better results
229 and stuff like that. Uhh. So yeah, yeah the experiment itself is definitely important in uh, finding what
230 you want.