Week 1

This has been a really great start to the summer REU! I began by getting an overview of the plan for the summer and the goals of the project in general through a zoom call with Laura Peticolas and the other students involved. I then attended some of the Boulder Solar REU events, such as the scientific overviews and the introduction to IDL, which took place the week before the start of my program. At the start of this week I met the team I’m working with and saw some presentations on what they individually are working on. I was sent a couple papers to read through, one that discussed SIR events and another that discussed CME events. These were very helpful to read, as although I got an overview of magnetosphere physics and types of atmospheric escape through the Lucas Maes paper, these went into much more depth and I feel I have a better understanding now of more intricate parts of this field. Most of this week I have been working on creating a large spreadsheet with data about geomagnetic storms from the FAST satellite. I am working with the years 1996 through 2009, and compiling data such as the timings and values of the minimum Dst of the storm and whether it is identified as a CME or SIR event.

Week 2

This week we had the MACH workshop on the mornings of Tuesday, Wednesday and Thursday. They were all very interesting and it was intriguing to hear about all the different studies being done in the field at the current moment. While some talks directly pertained to what I am focused on this summer, others were related to the general topic of magnetospheres and atmosphere escape but went on entirely different routes. Of course some of the information went over my head, but I found that a lot of what I had learned in previous classes started to come back to me through little reminders in these talks. After the talks every day, I got to work on the data organization for the geo storms. I discussed with Lynn and Chris about the ambiguity of many of the storm classifications, and I then went through and categorized them based on shape (classical and atypical) and also matched each storm to an SIR or CME classification as well as a FAST satellite orbit. This coming week I expect I will be logged into the system and begin working with this data in IDL.

Week 3

I have been working this week on classifying storms and starting to use IDL. Chris gave me a helpful tutorial to the program, which is surprisingly simple to use for at least the things I need for now. I’m getting going on analyzing the storm data through IDL and categorizing the stages of the sawtooth storms, and also some storms that I classified last week as “classically” shaped storms, which have some overlap with those that are sawtooths. I went to the weekly meetings with the team, and I’m hoping that this coming week I’ll have some work to share with the group as I wrap up the sawtooth storm stage categorization in IDL.

Week 4

This week I worked mainly on continuing to add detail to the large table of data that I have been making for all of the sawtooth events. I met with Lynn to discuss some of the ways that I could improve upon what I already had, and then added quite a bit more information. First, I compared all of the times that I had of the point of increase (when the solar flow pressure increases rapidly and causes the Dst index to drop, quickly leading to the onset of the storm) to some other data that I was provided of the times of “sudden commencements,” which were made using ground magnetometer stations. This allowed me to more accurately choose my points of increase rather than relying only on the patterns I saw in the Dst Index. I also went through and classified these increase points as “Gradual” or “Sudden,” which essentially referred to how long it took to reach a peak. I wrote up a document to go with this table that describes each column and the meaning of the labeling, as well as what is happening physically behind all of it. Aside from this, I attended the regular team meetings as well as the check in with Laura, Jade and Xinrun where we went through our Mentor-Mentee agreement and discussed Jade’s elevator pitch. This coming week I am hoping to get some feedback on my data table and description document, and work on my own elevator pitch.

Week 5

This was a very busy week! I have finished my large individual project where I went through each of the sawtooth storms and “classically shaped” storms and located the increase, onset, minimum Dst, recovery and long recovery, as well as the type of storm it was, the FAST orbit associated with it and the types of increase that were seen. Now that I have all of this data, Chris helped me load it into a routine that would create a folder of plots with each of these times labeled that I could go through and check for accuracy. When I find mistakes, I can edit the program to show the different plots in IDL and then I can edit the original data, load it back in, and have the final plots reflect the more accurate data. Alongside this, I am working with Niloufar to help her categorize the timing of her sawtooth injection points into the phases of the sawtooth events. This included mainly going through each injection point and finding where in the phases the points occurred. Finally, I am starting on the powerpoint slides for the final presentation. So far, it feels like I am finally getting into work that has actual results, so I am not positive how I am going to format the presentation yet.

Week 6

This past week I worked mainly on going through the folder of plots that was created last week and checking all of the data for accuracy. There were a LOT of things to correct - it was eye opening to see how important it was that I checked all this work, as a combination of small misjudgments and human error can result in very inaccurate data. Going through all of this took quite a bit of time, because after every error I found I needed to go back and redo the whole plot. Alongside this, I continued to help Niloufar with her categorization spreadsheet, where I mainly connected the timings of storm phases to the auroral boundaries she listed. I also worked on the powerpoint for the final presentation, although I am not able to fully finish it without the final plots.

Week 7

This week was a little less busy than the past few have been, and I mainly worked on the categorizations for Niloufar and wrapped up some of the work on checking the plots. I met with some people from the team to discuss the individual things that I was working on with them, and also with the team as usual. I worked on the powerpoint as well, and I am planning on changing a lot up after getting the results and also after thinking about how I would like it to actually flow.

Week 8

This is the last week at MACH! Most of this week I prepared for the presentation, which started out with showing the presentation to the FAST team for feedback, and nating notes on what to work on. Using this feedback I started making edits, and then noticed that I would like to add another section in the results component of the presentation that delved into some categorization of the storms based on their CME/SIR classification. I noticed one mistake while doing this, so I ended up going back through all of my original CME and SIR classifications to make sure that there were not more mistakes. This was a part of the spreadsheet that I made when I was still fairly new to the whole project, and so I actually found a few corrections that needed to be made.

I felt as though the presentations went well. I got a few chances to practice mine in front of our group with Laura and the students, and also with the FAST team, so I had that boosting my confidence. I thought that everyone else's presentations went great as well. I often get a bit nervous when doing public speaking, but I have noticed that decrease substantially since being on zoom. There are obvious disadvantages to being on zoom of course, but I have noticed personally that it helps me when speaking to more than just a handful of people at once.

I am a bit sad to have this internship come to a close. I was happy to participate in the piloting of it, and it was fun to work through it with everyone else. I am sure it will be very different in the future, and I do hope that it will be longer! I believe that eight weeks is substantial but maybe not substantial enough for this type of project, especially when coming in with little background knowledge as we all did due to being undergraduates. I feel as though I truly understood and appreciated what I was doing and then the program came to a close. That being said, I do feel that I accomplished a lot! As suggested, I just read through my journal entries from the whole summer, and I truly did learn a lot. I will give any other specific feedback in the survey, and otherwise, thank you for a lovely and fulfilling summer. Good luck with the future research to be done at MACH!