To narrow down the focus of our project, we have two ideas - one we like better and one as a backup if we don’t find the information we need in the next week. We will try to model why features of STEVE (Strong Thermal Emission Velocity Enhancement) happen. Unlike the aurora borealis typically hitherto seen and studied that looks like a thick horizontal ribbon in the sky and comes in many colors, STEVE is vertical, can extend for thousands of miles, and only comes in green and purple. It is caused by so-called “Birkeland” currents, or ion currents, moving rapidly east to west at a certain latitude (~60-80 degrees). We intend our model to look roughly like the following: a dipole approximation of Earth’s magnetic field, with particles randomly moving from east to west across it and forming STEVE when they hit the magnetic field within a certain region. We want to model the criteria for making purple and green colors, but if we can’t find the information on how those colors form (which we have not yet), we will instead do our backup idea.

Our backup idea is to model the Earth’s magnetic field, as a dipole approximation orbiting the Sun, throughout the year and discuss why the aurora is more likely to be seen in Spring and Fall due to the orientation of the magnetic field. We don’t plan to go with that idea, because we think we’ll find enough information on STEVE, but if needed, that timeline will look similar to the one below but with information and models of the magnetic field orientation in different seasons, instead.

The ultimate product will be a description of why STEVE happens, how it’s different from other aurora borealis, what it looks like in a rough simulation, and what criteria lead to different features of STEVE.

Additional, more focused resources to what we had before:

Resource for the differences in seasons of aurora:

<https://www.nasa.gov/mission_pages/themis/auroras/aurora_live.html>

Resources on how STEVE is different from other auroras:

<https://www.express.co.uk/travel/articles/935071/the-northern-lights-2018-new-aurora-steve-discovered>

Scientific Paper about STEVE:

<http://advances.sciencemag.org/content/4/3/eaaq0030>

Birkeland Current: <https://www.plasma-universe.com/Birkeland_current>

What is a substorm, etc.: <https://www-spof.gsfc.nasa.gov/Education/wsubstrm.html>

Cute picture of how northern lights happen: <http://earthsky.org/earth/what-causes-the-aurora-borealis-or-northern-lights>

Colors of the northern lights: <http://www.webexhibits.org/causesofcolor/4D.html>

Maybe describes colors of STEVE: <https://news.nationalgeographic.com/2018/03/steve-auroras-identified-plasma/>

We have yet to divvy up the work among us separately but have so far been working together on everything and will either continue doing that or will fairly split up the work each week.

Detailed timeline:

Due date: Deliverable:

3/30/2018 Do more reading and decide on if modelling the conditions for

Steve is doable (i.e., do we know enough information about why Steve happens so that we can model it); we will create a list of conditions needed to see the optical phenomena after reading more; we will get or create a graphic of all of the elements of Steve; make a list of all new definitions of words that we are using

\*\*In early April, we hope to make a field trip north to see aurora borealis, pending class schedules and solar activity. Dark skies park is within driving distance so we might go there\*\*

4/6/2018 We will have a working code of the earth’s magnetic field and

solar particles; we will need to research solar particles to understand what elements we need to model (i.e., charge, current/flow, and size); there may or may not be any interactions coded between the magnetic field and the particles

4/13/2018 We will make sure that the field lines are visible in our code; we

will also try to produce a graph of the wavelength of visible light to show that only purple and green light show up in Steve

4/20/2018 We will start to make our poster along with continuing to

troubleshoot and work on our code; we will plan on getting the introduction portions and the figures portion of our poster done

4/27/2018 We are finalizing our conclusions and answering the questions:

Why does STEVE happen? And what does STEVE look like?