Aurora Borealis and STEVE

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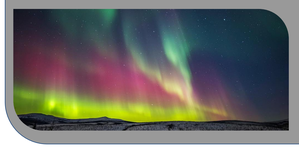
Background

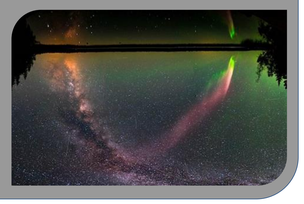
Aurora Borealis

- Usually green, yellow, and red
- Can also be green, violet, and blue
- Curtain shaped
- Can be at 60-90 MLAT (magnetic latitude)
- Formed by charged particles in solar wind that interact with the earth's magnetic field
- Last about 10 mins to all night
- Highest activity in the nothern latitude is during spring becuase of sun magnetostorms
- Activity happens in 22 year cycles
- About 10 degrees latitude high



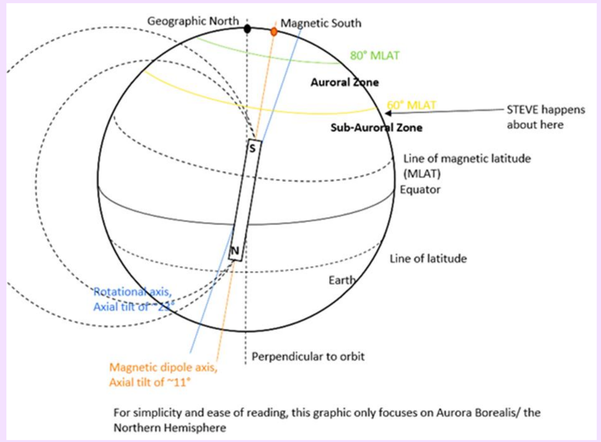
STEVE

- Purple in color
- Sometimes seen with green aspects
- Typically a verticle arc
- Formed by subauroral ion drifts that occur during substorms
- Last about 20 mins to an hour
- Seasonal: not observed in winter (October - February)
- About 0.5 latitude wide

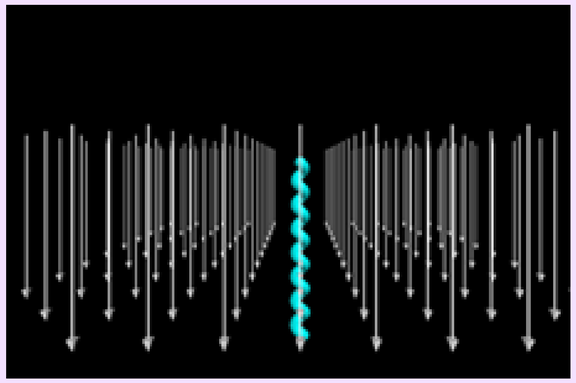


Comparison of key features of the aurora borealis and of STEVE (Strong Thermal Emission Velocity Enhancement)

Physics of Aurora Borealis



Representation of Earth's magnetic field in the dipole approximation model



Particle moving through uniform magnetic field, under effects of Lorentz force

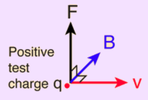
Particle moving through Earth's dipole magnetic field

(Currently there's no particle moving through as that's one of the places we're stuck and still working)

How does a charged particle interact with a magnetic field?

- The particle will feel a force, called the Lorentz force, which is the cross product between the velocity of the particle and the magnetic field
- This causes the particle to spiral around a static and constant magnetic field

$$\vec{F} = q\vec{v} \times \vec{B}$$



Aurora Borealis versus STEVE

When we get our code working, here there will be a picture of particles moving in different parts of the Earth's magnetic field, as STEVE occurs at a different latitude than regular Auroras

References

[1]