Lec 19\_Magnetopause. This lecture covered the characteristics of the Magnetopause, its current, polar cusps, and the magnetotail. The magnetopause is the outer boundary of the magnetosphere, its location is determined by the pressure balance between the solar winds and the magnetic field. The Magnetopause current is the charged particles entering and being deflected by the forces within the magnetopause. Polar cusps are the high latitude funnel shaped regions where the geomagnetic field lines are open to the magnetosheath. The magnetotail is the elongated region of the magnetosphere that streches anti-sunward on the night side of the earth. One last point was about the plasma sheets, whose location are not close enough to the geomagnetic feild for curvature drift to be an issue, but still while on the closed field lines. When convection occurs, material from the plasma sheet starts to populate the inner magnetosphere.

Lec20\_Magnetosphere convection. Lecture 20 covered the basics of the magnetosphere convection. This topic included; energy input and output, Russell-McPherron effect, and sub-storms. Magnetosphere convection allows solar wind kinetic energy to be converted into magnetic energy into positive in the magnetotail. Energy input and output refers to the amount of energy that enters the mangetosphere is dependent on the solar wind speed, IMF field strength, and clock angle. The Russell-McPherron effect is the efficiency of the solar wind input is at its highest during the equinox's due to the geomagnetic field orientation with respect to IMF. Sub-storms are the process of generating aurora through newly closed field lines returning sun-ward towards dusk and dawn at lower altitudes. sub-storms have three phases, growth, expansion, and recovery.

Lec21\_InnerMagnetosphere. The inner magnetosphere is the region of closed, generally bipolar field lines within the equatorial distance of about 8 RE­ of Earth. Occupied by ions and electrons of various energies, separated into three grounds. Low Energy ( Plasmasphere ), Mid Energy ( Ring Current ), and High Energy ( Radiation Belt ). The Plasmasphere consists of plasma from the ionosphere and has a high plasma density and low energy (<= 1Ev), it exhibits plasma drains during storms. The Ring Current has energy from 1-300Ev and a density around 1-10cm-3. This region’s primary highlight in the lecture dealt with charge exchange. Lastly, we covered the Radiation belt region, with characteristics of low density, high energy particles up to 10MeV. One characteristic covered in lecture was that of Magnetopause shadowing; where particles with different pitch angles have slightly different paths, can remove particles selectively by their escape through the magnetopause.

Lec22\_Ionosphere. This Ionosphere was covered in 5 parts; the Ionosphere, Ionization, Recombination, Ionospheric Structure, and Conductivity. The Ionosphere is a region of charged particles that extends upward form the top of the mesosphere into the thermosphere. In this region electrons and ions are created by solar radiation and recombined through a variety of processes. Ionization, photonization by solar X-rays and EUV radiation is responsible for the formation of the ionosphere. Chapman Profile: Ionization profile obtained by assuming one atomic species, monochromatic solar radiation, and constant temp. Recombination: In the ionosphere, ionization is balance by recombination. Recombination occurs through three processes, dissociative recombination, radiative recombination, and radiative attachment. Ionosphere structure: Charge density in the ionosphere varies with time of day, time in solar cycle, and latitude. Four layers are preent, D region, E region, F1 and F2 region. Conductivity: below 100km neutral collision dominate over electromagnetic effects.

Lec23\_Magnetosphere\_IonosphereCoupling. Ionosphere is essentially the base of the magnetosphere, connected everywhere through magnetic field lines. Precipitation into the atmosphere occurs in the form of Aurora precipitation, diffuse and discrete. Diffuse precipitation is very thinly spread out over a wide range. Discrete precipitation is associated with currents into the atmosphere. Coupling via field-aligned currents and the Birkeland currents. Birkeland currents are field aligned currents that continuously flow through the ionosphere. Pressure gradients within closed field line regions divert equatorial currents into the ionosphere. Currents within the ionosphere though multiple phenomenon; Ionosphere electric fields, Pedersen currents, and Auroral Electrojets. When the magnetosphere deposits energy into the ionosphere through precipitation in currents it’s called Joule Heating. Joule heating is due to collisions of the plasma flowing through the neutral atmosphere.

Lec24\_GeomagneticActivity. Geomagnetic activity are the events on the sun can send intense radiative and ejecta earthward which can adversely affect life and technology through its effects on the magnetosphere and atmosphere. This lecture also covered Space weather, Measurements, geomagnetic storms, sub storms and their effects and warnings. “Space weather” refers to the condition of the heliosphere environment. Space weather terminology included Galactic Cosmic Rays, Solar Energetic Particles, Coronal holes and high-speed streams. Measurements are made at the lambda = 10.7 cm radio flux length as this correlate well with the number of sunspots and EUV emissions that affect the ionosphere and atmosphere. Geomagnetic Storms: defined periods of disturbed equatorial surface magnetic field. Divided into “main event” and “recovery event”. Substorms are reconnection eve nts in the magnetotail that direct plamsa earthward. These events and geomagnetic activity effect life on earth through ground induced currents or GICs. Storms and events are measured and indicated through Kp intensity. Kp is based on ground magnetometer data and measured from 0 (no activity) to 9 (extreme storm).

Lec25\_MagnetosphericWaves. Parameters of a wave include, angular frequency, wave vector specifying direction, dispersion relation relating the previous two, phase speed, group speed, and sound speed. The Plasma beta parameter relates plasma pressure to magnetic pressure. Types of Magnetospheric waves include MHD, Alfven, and Magnetosonic. Electrostatic waves occur only when the electric field, not the magnetic field oscillates. Electromagnetic waves such as ordinary light propagate perpendicular to the electric and magnetic field. The lecture covered 5 types of electromagnetic waves in the magnetosphere. Ultra low frequency (ULF), Electromagnetic ion cyclotron (EMIC), Chorus, Plasmaspheric hiss, and Ion Acoustic waves.