1. Properties of waves in a cold magnetized plasma depend on two parameters, number density $n$, and magnetic field strength $B$, or in terms of $\omega_p^2$ and $\omega_c$ (or their ratio with the wave frequency $\omega$). Therefore, we can classify these waves in a diagram with two axis, i.e., the CMA diagram.

2. A simplified version of the CMA diagram is constructed with electron terms only, i.e., assuming the wave frequency $\omega$ is much larger than the ion cyclotron frequency. For a CMA diagram with a single ion species, the part with $\omega$ near or above the electron cyclotron frequency is approximately given by this simplified version.

3. The CMA diagram can help determining whether a wave can access another region of space if plasma parameters ($n, B$) vary slowly spatially.

4. The CMA diagram is first constructed by drawing bounding surfaces (curves for solutions of $R = 0, L = 0, S = 0, P = 0, R = S = D = \infty, L = S = D = \infty$).

5. The regions of parameter space enclosed by these bounding surfaces are bounded volumes. Within each bounded volume, the index of refraction surfaces remain the same topology. Such topology is sketched in Fig. 4.36 and 4.41.

Homework #4 (due Friday, October 9th, before class): Problem # 4.10, 4.12, 4.13, 4.17, 4.20, and the following question from the 2007 Comprehensive exam:

Consider a uniform, cold electron-positron plasma. Neglect annihilation. Assume $E_i = E_1 e_z$ and that $n_0^+ = n_0^- = n_0$ where $n_0^+$ and $n_0^-$ denote the number densities of positrons and electrons, respectively.

a) (60 points) Show that the dispersion relation in this electron-positron plasma is given by

$$\omega^2 = 2\omega_p^2 + c^2k^2,$$

where $\omega_p$ denotes the plasma frequency and $c$ is the speed of light.

b) (40 points) Calculate the cutoff and resonance frequencies (if they exist).