

PHYS:7729 Homework #1

Cold Plasma Wave Presentations:

Wave choice to be determined in class on Tuesday, January 24, 2023.

Presentations will be given in class on Tuesday, January 31, 2023 and Thursday, February 2, 2023.

Choose one of the following cold magnetized plasma waves with the specified limits:

1. Cold Plasma Alfvén Waves, $\omega \ll \omega_{ci} \ll |\omega_{ce}| < \omega_{pe}$, $k \rightarrow 0$
2. Ion Cyclotron Waves, $\omega \simeq \omega_{ci}$, $k \rightarrow \infty$
3. Whistler Waves, $\omega_{ci} \ll \omega \ll |\omega_{ce}| < \omega_{pe}$
4. Electron Cyclotron Waves, $\omega \simeq \omega_{ce}$, $k \rightarrow \infty$
5. LH & RH Circularly Polarized Modified Light Waves, $\omega > \omega_L$
6. Magnetoacoustic (Fast) Wave, $\omega \ll \omega_{LH}$, $k \rightarrow 0$
7. Upper Hybrid Waves, $\omega^2 \simeq \omega_{pe}^2 + \omega_{ce}^2$, $k \rightarrow \infty$
8. Ordinary Mode Light Waves, $\omega > \omega_{pe}$
9. Extraordinary Mode Light Waves, $\omega > \omega_R$

Each student will choose a wave (with the order of choice being determined randomly) in class on Tuesday, January 24th. Please come to class with your preferred choices. The first five to choose will present on Tuesday, January 31st, and the last four to choose will present on Thursday, February 2nd.

For the wave you have chosen, you will give a 10–12 minute presentation before class about the wave mode. In addition, please prepare a 1–2 page summary for distribution as notes to the class. You do *not* need to go through all of the mathematical steps in this summary, but please do outline the path you followed. Each presentation and summary should cover the following:

1. Limits of the wave (setup of \mathbf{k} , \mathbf{B} , and limits of frequency and wavenumber)
2. Ion and electron current
3. Limiting behavior
4. Solution of the mode frequency
5. Physical description of the mode
6. Cartoon of the wave mode motion (this is important).