PHY239B (Fall Q, 2016)

Plasma Physics B

(graduate course, Department of Physics and Astronomy)

Instructor: **Professor Toshiki Tajima**

Norman Rostoker Chair Professor

We study the macroscopic aspect of the behavior of plasma in this course. The ultimate macroscopic treatment of many-body system of charged particles (plasma) is the statistical mechanical representation of plasma, assuming the plasma being a uniform entity (a 0D approach). Often, however, it is crucially important to treat plasma more than 0D. In this case we represent the plasma by a fluid whose properties depend on spatial and temporal coordinates. We will treat some examples of such description of plasma, such as the Rayleigh-Taylor instability (gravitational instability), the Kelvin-Helmholtz instability (the shear flow instability), etc. We will also examine what this fluid model dispenses. For example, we will study the wakefield, which is essentially a fluid-like dynamics of plasma. However, the wakefield acceleration is kinetic effects, which cannot be described by the fluid model.

The students will be given a code and a term project, through which they will learn and examine these principles and embodiments. (As was the case in the past classes) some successful students may get a meaningful result, which may be even publishable.

Refs:

S. Ichimaru, “Basic Principles of Plasma Physics” (Benjamin, Reading, 1973).

T. Tajima and K. Shibata, “Plasma Astrophysics” (Addison-Wesley, Reading, 1997).

Some copies of lecture notes (TBD).