

SEMINAR

**Plasma Physics Division
Naval Research Laboratory**

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***Title:* Plasma Engine: Possibility of Extracting
Mechanical Work from Solid Particles
Immersed in Plasma**

***Date:* Friday, 1 October 2004**

***Time:* 1:30 p.m.**

***Location:* Bldg. 71, Room 1440 (Door M, North Side)**

Micron or sub-micron sized particles immersed in a quasi-neutral plasma acquire a net charge due to differential thermal fluxes of ions and electrons. The force on the charged particles due to shielded electric fields is like pressure force i.e., it tries to expel particles for the regions of high particle density. This expansion energy of particles is available for work. An adiabatic equation of state that relates the “pressure” to particle density will be derived. Extending these concepts a thermodynamics will be constructed where an ensemble of particles is characterized by three state variables i.e., P (pressure), V (volume occupied by the particles) and N (number of particles) two of which are related by the equation of state. Using these concepts it will be shown that by manipulating the N and V it is possible to construct an engine using micron-sized particle as “working fluid”. That is, a certain number of particles are extracted from a reservoir of particles and plasma at higher plasma potential (source), part of the particle energy is converted into work (PdV) and the remaining energy is rejected into a another reservoir of particles and plasma at lower plasma potential. Numerical examples of Diesel and Otto cycles will be discussed which show that for reasonable particle and plasma parameters, energy and power density comparable to internal combustion engines may be obtained with good efficiency. Finally, the possibility of detonation (explosive release of particle expansion energy) will be discussed.

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