NRL BAA Announcement
#67-09-01

BASIC AND APPLIED RESEARCH IN HIGH TEMPERATURE PLASMAS

The Naval Research Laboratory (NRL) is interested in receiving proposals that address basic and applied experimental, theoretical and computational research to advance fundamental knowledge in high temperature plasmas.

Specific areas of interest include:

(1) Theory, modeling and simulation describing the interaction of intense ultrashort laser pulses with designer targets for the production of energetic particles such as neutrons, protons, electrons and charged ions as well as x- and gamma-rays for the remote interrogation of weapons of mass destruction (WMD) materials for the global war on terrorism (GWOT). (a) Advanced computer models combining hydrodynamics and radiation physics in dense plasmas; atomic physics in high intensity fields. Physics of Laser – Cluster dynamics, X-ray channeling and propagation. Theoretical and computational studies of plasma chemistry and processes for application to air chemistry and excimer lasers.

(2) (a) Theoretical and experimental studies of krypton-fluoride laser systems, both single pulse and repetitively pulsed, includes pulsed power, optics and electron beam generation, propagation and transport. Theoretical and experimental studies of the effects of laboratory thermonuclear explosions upon the chamber walls and upon the final optics. Study of means for fabrication and injection of targets for high-gain laser fusion. (b) Study of laser-matter interactions and strongly-coupled plasmas for conditions relevant to direct drive laser fusion. Theory and experimental studies of laser-plasma instability at high intensity that are relevant to laser fusion.

(3) High energy pulsed power systems employing capacitive and inductive energy storage; production of pulsed plasma and intense high-power, charged particle beams including single pulse and high average (rep-rated) power systems.

(4) Theoretical and large-scale computational modeling of ionospheric, magnetospheric, solar and space plasmas; observational diagnostics of the near-earth space environment.

(5) Nonlinear dynamics and chaos; theoretical studies and computer simulations of nonlinear dynamic phenomena and novel nonlinear algorithms for use in applications

such as signal processing, analysis of complex data sets, neural architectures, and control systems; emergent structures in stochastic dynamics.

(6) Theoretical and experimental research in the areas of coherent radiation sources, systems, and propagation, including gyrotrons, magnicons, high energy lasers, ultrashort pulse lasers, and free-electron lasers; theoretical and computational research in beam transport simulations, intense laser-plasma interactions, intense laser-electron beam interactions, and modeling of plasma processing.

(7) Diagnostic and data handling/analysis techniques applicable to pulsed or dc measurements for remote sensing, and laser-matter interactions including real time diagnostics and post-interaction analysis.

(8) Theoretical and experimental research and development for high power RF sources, beam handling systems and pulsed or continuous plasma discharges; analysis of moderate temperature discharge plasmas using innovative spectrographic and electrical diagnostics.

(9) Theoretical and experimental research on high frequency microwave processing of ceramics including modeling of intense microwave-material interactions and development of low cost, high power millimeter wave applicators and sources.

(10) Experimental research in high-velocity electromagnetic launchers; design of launcher barrels and armatures; diagnostics of launcher performance; pulsed power systems for electromagnetic launch.

(11) Theoretical and experimental research of the physics of high-energy-density plasma (HEDP) physics, including equation-of-state, advanced plasma diagnostics, and computational tools for modeling atomic-nuclear coupling in HEDP environments.

(12) Development of novel and robust detection systems suitable for high-power pulsed environments, consisting of temporally-, spatially-, and/or spectrally-resolved detectors for x-ray, high-energy gamma, or neutron (both fast and thermal) emissions and mode-differentiating data acquisition electronics.

(13) Theoretical and experimental research to quantify cross-sections of nuclear resonance fluorescence, Coulomb excitation, neutron inelastic scattering, and nuclear excitation via atomic processes of radioisotopes.

The foregoing description should be interpreted within the following guidelines which apply to all BAA topics but are stated here for emphasis: (1) NRL is not interested in concepts that have already been developed or proven; (2) NRL seeks proposals for scientific study and experimentation directed toward advancing the state-of-the-art or increasing knowledge or understanding; and (3) deliverables should demonstrate the results of scientific study and experimentation rather than focus on a specific system or

hardware solution. Proposals for evolutionary improvements are inappropriate under BAA authority and are note desired.

Address White Papers (WP) to Code 6701, or e-mail, telephone (202) 767-2997 or 767-5635. Allow one month before requesting confirmation of receipt of WP, if confirmation is desired. Substantive contact should not take place prior to evaluation of a WP by NRL. If necessary, NRL will initiate substantive contact.