Special Notice 11-SN-0002
Special Program Announcement for 2011 Office of Naval Research Basic Research Challenge: "Novel Electronic Devices Based on Coupled Phase Transitions"

I. INTRODUCTION:

This announcement describes a basic research thrust, entitled "Novel Electronic Devices Based on Coupled Phase Transitions," to be launched under the ONR BAA 11-001, Long Range Broad Agency Announcement for Navy and Marine Corps Science and Technology which can be found at http://www.onr.navy.mil/Contracts-Grants/Funding-Opportunities/Broad-Agency-Announcements.aspx. The research opportunity described in this announcement specifically falls under numbered paragraph 2 of the "Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (Code 31)" sub-section and numbered paragraph 2 of the "Sea Warfare and Weapons (Code 33)" sub-section. The submission of proposals, their evaluation and the placement of basic research grants will be carried out as described in that Broad Agency Announcement.

The purpose of this announcement is to focus attention of the scientific community on (1) the area to be studied, (2) a workshop for dialogue amongst those interested in this arena, and (3) the planned timetable for the submission of white papers and proposals.

II. TOPIC DESCRIPTION: NOVEL ELECTRONIC DEVICES BASED ON COUPLED PHASE TRANSITIONS

The proposed topic will explore and exploit the use of coupled phase transitions in the context of electronic devices. The program will pursue an integrated development of materials exhibiting transitions, understanding of the physics governing the behavior of the transitions and novel device designs to harness the phenomenon for unprecedented performance, potentially on the femto-second timescale.

Background:

Electronic and magnetic materials operated near phase transitions are widely used for their dramatic non-linear properties to enhance performance in practical electronic devices. For example, modern capacitor dielectric films are made from materials near the ferroelectric transition. The exploitation of electronic phenomena due to phase transitions themselves has barely begun. For example, functionality has been demonstrated when two or more modes (dielectric, magnetic, elastic, electronic) are linked near coupled-mode phase transitions as in piezoelectric material where the electric polar distortion is linked to the elastic shape distortion. Such materials are used in many conventional applications – tunable capacitors in electronic circuits and piezoelectrics in acoustic sensors and sources. The possibilities of structuring coupled phase materials was recently demonstrated through a study of layered material with varied polarization properties in the perovskites oxides (LAO/STO). The thin film unexpectedly

yielded 2D electron gases with an order of magnitude higher sheet charge concentration than available from conventional semiconductor technologies, including Gallium Nitride, along with a range of other properties such as the quantum Hall effect and the metal insulator transition. Exploring the physics and developing devices that utilize these phase change phenomena is the focus of this Basic Research Challenge. The metal insulator transition (Mott transition) phenomena in particular, where material can changes from an insulator to a conductor with conductivity changes of over 5 orders of magnitude, is a research direction of interest. Decades ago it was shown that such changes could be controlled by changing the impurity doping or temperature. These materials became of even greater technological interest when a recent demonstration showed an electrically driven transition and separately that the switching time measured optically was on the order of 100 femtoseconds, suggesting the possibility of new ultrafast switching devices. Again, the potential for enhanced electronic devices with new device topologies or improved performance is clear. The realization of this potential is expected to be accelerated by this basic research effort directed toward both development of novel device structures and a fundamental understanding of the physics of these structured materials.

Objective:

The Office of Naval Research (ONR) is interested in receiving proposals for the design, build and test of innovative electronic devices exploiting enhanced materials properties stemming from coupled phase transitions. The multidisciplinary team creating these novel devices must integrate physics, chemistry, materials science and electrical engineering to produce useful options for system innovations. This program is not limited to the oxide materials referenced above but rather encourages detailed exploration of the relative merits of a broad range of promising candidates based on an understanding of the fundamental physics to achieve optimal integrated device performance.

III. WORKSHOP

ONR will hold an optional workshop in the interval of **Wednesday 5 January through Thursday 6 January 2011** in the Executive Conference Center of Strategic Analysis Inc on the Third Floor of 4075 Wilson Boulevard, Arlington, Virginia (at the intersection of Wilson Boulevard and North Randolph Street). There is no registration fee for participation in this workshop; meals will be on your own.

ADVANCED REGISTRATION IS REQUIRED.

Workshop participants will have the opportunity to present their potential approaches through a short presentation (10-15 minutes) and a poster display as well as meet other interested parties to discuss potential teaming arrangements prior to submission of white papers.

All interested workshop participants must submit their abstracts **on or before 15 December 2010**. All abstracts will be included in an abstract book and that abstract book may be distributed by ONR. Although it is expected that all workshop participants will have the opportunity to present, ONR reserves the right to limit the number or type of presentations and all parties may

not have the opportunity to present. PowerPoint should be available to presenters and the details for how to submit PowerPoint presentations will be included on the registration website.

The workshop website: http://events.SignUp4.com/workshop2011me provides the format for (1) a one-page abstract, (2) registration details, and (3) information about nearby lodgings/restaurants. Workshop participant contact information may be distributed by ONR.

Registration for workshop participation is **no later than 15 December 2010** to ensure optimal placement on the agenda.

It is expected the workshop agenda, including when participants will be presenting, will be posted to the workshop website **around 21 December 2010**.

The Workshop Coordinator is Ms. Michelle Aftimos, (703) 696-4403, Workshop2011ME@onr.navy.mil), who is the single point of contact for information on the workshop organizational details.

IV. WHITE PAPER SUBMISSION

White papers should not exceed 4 single-sided pages, exclusive of cover page and resume of principal investigator, and should be in 12-point Times New Roman font with margins not less than one inch. The cover page should be labeled "White Paper for 2011 Basic Research Challenge: Novel Electronic Devices Based on Coupled Phase Transitions" and include the following information: title of the proposed effort, technical point of contact, telephone number, fax numbers, and e-mail address. The 4-page body of the white paper should include the following information: (1) Principal Investigator; (2) Relevance of the proposed effort to the research areas described in Section II; (3) Technical objective of the proposed effort; (4) Technical approach that will be pursued to meet the objective; (5) A summary of recent relevant technical breakthroughs; and (6) A funding plan showing requested funding per fiscal year. A resume of the principal investigator, not to exceed 1 page, should also be included after the 4-page body of the white paper.

Although not required, white papers are strongly encouraged for all offerors seeking funding. Each white paper will be evaluated by the Government to determine whether the technology advancement proposed appears to be of particular value to the Department of the Navy. Initial Government evaluations and feedback will be issued via e-mail notification from the Technical Point of Contact. The initial white paper appraisal is intended to give entities a sense of whether their concepts are likely to be funded.

Detailed Full Proposal (Technical and Cost volumes) will be subsequently encouraged from those Offerors whose proposed technologies have been identified through the above referenced e-mail as being of "particular value" to the Government. However, any such encouragement does not assure a subsequent award. Full Proposals may also be submitted by any offeror whose white paper was not identified as being of particular value to the Government or any offeror who did not submit a white paper.

For white papers that propose efforts that are considered of particular value to the Navy but either exceed available budgets or contain certain tasks or applications that are not desired by the Navy, ONR may suggest a full proposal with reduced effort to fit within expected available budgets or an effort that refocuses the tasks or application of the technology to maximize the benefit to the Navy.

White papers should be submitted electronically to the program technical points of contact, Dr. Daniel Green, daniel.s.green1@navy.mil, and Dr. Wallace Smith, wallace.smith1@navy.mil. These white papers shall be in Microsoft Word or Adobe PDF format.

To ensure full, timely consideration for funding, white papers should be submitted **no later than Thursday, 3 February 2011**. White papers received after that date will be considered as time and availability of funding permit.

The planned date for completing the review of white papers is **24 February 2011**.

V. FULL PROPOSAL SUBMISSION AND AWARD INFORMATION

Full proposals (including one technical volume and one cost volume) should be submitted under **BAA 11-001** by **24 March 2011**. Full Proposals received after that date will be considered as time and availability of funding permit.

ONR anticipates only **grants** will be issued for this effort. All full proposals must be submitted through www.grants.gov. In the "Federal Identifier" field, all offerors should insert "312 Challenge Green/Smith". All attachments to the application should also include this identifier to ensure the proposal and its attachments are received by the appropriate Program Office.

ONR plans to fund three to five individual awards with a value of $100,000.00 to $750,000.00 per year, using Basic Research funds. However, lower and higher cost proposals will be considered. The period of performance for projects may be from one to four years.

Although ONR expects the above described program plan to be executed, ONR reserve the right to make changes.

Funding decisions should be made by **14 April 2011**. Projects will have an estimated grant award date of **1 June 2011**.

VI. POINTS OF CONTACT

In addition to the points of contact listed in BAA 11-001, the specific points of contact for this announcement are listed below:

Technical Points of Contact:
Dr. Daniel Green, Program Officer, daniel.s.green1@navy.mil
Dr. Wallace Smith, Program Officer, wallace.smith1@navy.mil

Business Point of Contact:
Ms. Susan Parrott, Contracting Officer, Email Address: susan.parrott@navy.mil

Workshop Point of Contact:
Ms. Michelle Aftimos, Workshop Coordinator, Email Address:
Workshop2011ME@onr.navy.mil