NRL BAA Announcement
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SPINS IN SEMICONDUCTORS

The Naval Research Laboratory (NRL) is seeking proposals for research and development leading to new materials, devices, components and subsystems using spins in semiconductors.

Recent experiments have suggested that the spin degree of freedom of the electron, or selected nuclei, can be utilized to enhance the performance of existing microelectronic devices. Even more significantly, control of the phase of the spin wave function may enable the development of revolutionary new electronics wherein the charge degree of freedom of the electron is replaced by the spin degree of freedom enabling the performance of very high speed logic and memory operations at much lower power than conventional electronics. In addition, electron or nuclear spins in semiconductors may be perfect candidates for quantum information processing and communication. Research and development related to this area is also of interest.

This program is seeking innovative ways to utilize the spin degree of freedom in semiconductors. There are several areas that have been identified that are of particular interest.

1) Spin Quantum Devices: these devices, based on more conventional microelectronic devices, add spin polarized transport to enhance their performance. Devices such as spin field effect transistors (spin-FETs), spin light emitting diodes (spin-LEDs), spin resonant tunneling diodes (spin-RTDs), etc., use control of a spin polarized current of electrons to add functionality.
2) Spin Coherent Devices: these devices are based on the recently discovered optically excited, very long-lived coherent spin state in bulk semiconductors and semiconducting heterostructures. This coherent state can be controlled using small magnetic and electric fields and its quantum mechanical phase can be manipulated at frequencies significantly above a teraHertz.
3) Spin Quantum Information Processing and Communication: the utilization of electronic or nucleonic spin as the quantum bit (qubit) is currently at the forefront of this technology.

In addition to the areas that are specifically mentioned above, NRL is also interested in other highly innovative ways to exploit the spin degree of freedom in other potential spintronics applications including but not limited to memory storage, nanoscale electronics, nanoscale photonics, and nanoscale biology, mechanics, and sensors. The goal is to provide significantly enhanced performance or totally new functionality in electronics, opto-electronics sensors and quantum information processing.

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