Quantum enabled new metrology: E-field sensing/imaging with neutrons

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Technology of imaging electric field (E-field) has many potential applications, and E-field imaging becomes even more challenging when the electric field is physically isolated, shielded, and/or inside an occupied space. In this seminar, I am going to present how we utilize the electrically neutral particles, neutrons, to achieve E-field sensing/imaging that other existing E-field probing technologies cannot do. The proof-of-principle experiments were conducted at NIST Center for Neutron Research (NCNR), and we demonstrated neutron E-field detection at standard quantum limit (SQL). I will talk about the motivation, the development history, and the E-field imaging results of this research work. I will discuss the relevant physics and show how we exploit the quantum properties of neutrons to enable this new metrology capabilities. Then I will talk about how we can in-principle further improve this new neutron sensing technology by introducing a non-classical quantum state, spin-squeezed state, for neutrons. Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

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