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### **Optics with Nitrogen Vacancy Centers in Diamond**

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Quantum optical techniques can be used for cooling and coherent manipulation of atom-like systems in solid-state. This talk will focus on applications of these technique to quantum control of nitrogen vacancy (NV) centers in diamond. Specifically, we will demonstrate that Coherent Population Trapping can be used for optical cooling, real-time measurement and manipulation of nuclear spin dynamics surrounding NV centers. In addition, novel implementations of cavity QED with NV centers will be described. Finally, potential applications of these techniques to nanoscale magnetometry and realization of quantum networks will be discussed.