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### **Charge- and Spin-Based Devices in ZnO Thin Films and Nanostructures**

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ZnO is a wide bandgap semiconductor of potential for device concepts based on charge and/or electron spin. As a direct bandgap material with emission in the ultraviolet, ZnO is being actively pursued in the areas of ultraviolet light emitting diodes and laser diodes. The critical issue in developing such optoelectronic devices is p-type doping. As a dilute magnetic semiconductor, numerous experimental reports indicate ferromagnetism in transition metal doped ZnO. However, the mechanism for this magnetic behavior continues to be a topic of debate. In addition, numerous techniques have been utilized to synthesize ZnO nanoscale structures, many of which appear to be useful for sensors and nanoelectronics. In this talk, pertinent issues for spin and charge-based ZnO devices will be discussed. The focus will be on p-type doping, pn junction formation, magnetic doping, and nanowire-based sensor development. This work is supported by the National Science Foundation (DMR-029086), the Department of Energy (DE-FC26-04NT42271), and the Air Force Office of Scientific Research (030967).