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Final Oral Examination for the Ph. D. Degree

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Plasmonics and Magneto-Plasmonics in Thin Films and Nanostructures

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Open to the Public

Abstract: The work presented here concerns the optical and magneto-optical responses of thin films (metallic, conducting oxide, and metal-to-insulator phase transition thin films) and metallic nanoparticles, under the excitation of surface plasmon polaritons (SPPs) and localized surface plasmon resonance (LSPR). The underlying aim of this thesis is to build the current understanding of SPP/LSPR excitation in various nano-materials, and thus provide exciting alternatives in plasmonic based applications. In this thesis, we present our research work on SPPs and LSPR studies in different kinds of thin films and nanoparticles. We present theoretical and experimental studies on the observed strong enhancement of the magneto-optical Faraday rotation in all-metal core-shell Fe-Ag/Co-Ag nanoparticles, attributed to strong LSPR excitation in the noble metal shells. We also report observation of optically excited SPPs and bulk plasmons in ruthenium oxide (RuO_2) thin films, offering an exciting alternative to conventional metals for metamaterials and plasmonic applications, due to their low optical losses in the visible and near-infrared ranges. Finally, we report on the first observation of optically excited tunable SPPs in vanadium dioxide (VO_2) thin films during its thermally induced metal-to-insulator phase transition.

Bio: Lei Wang was born in Lishu, Jilin Province, China in 1984. She attended the University of Science and Technology of China and was awarded her Bachelor's degree in 2008. After graduation, she continued her studies in physics at the College of William and Mary, being awarded her Master's degree in 2010. She is currently pursuing her PhD degree in Physics at the College of William and Mary where she is expecting her degree to be awarded in May 2015.