Notice of the Final Oral Examination
for the Degree of Master of Applied Science

of

STEVEN JONES

BSc (University of Victoria, 2015)

"CHARACTERIZATION of SINGLE NANOPARTICLES"

Department of Electrical and Computer Engineering

Wednesday, July 6, 2016
1:30 P.M.
Engineering Office Wing
Room 230

Supervisory Committee:
Dr. Reven Gordon, Department of Electrical and Computer Engineering, University of Victoria (Supervisor)
Dr. Geoffrey Steeves, Department of Physics and Astronomy, UVic (Outside Member)

External Examiner:
Dr. Frank Van Veggel, Department of Chemistry, UVic

Chair of Oral Examination:
Dr. Byoung-Chul Choi, Department of Physics and Astronomy, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Optical trapping is a method which uses focused laser light to manipulate small objects. This optical manipulation can be scaled below the diffraction limit by using interactions between light and apertures in a metal film to localize electric fields. This method can trap objects as small as several nanometers. The ability to determine the properties of a trapped nanoparticle is among the most pressing issues to the utilization of this method to a broader range of research and industrial applications. Presented here are two methods which demonstrate the ability to determine the composition of a trapped nanoparticle.

The first method incorporates Raman spectroscopy into a trapping setup to obtain single particle identification. Raman spectroscopy provides a way to uniquely identify an object based on the light it scatters. Because Raman scattering is an intrinsically weak process, it has been difficult to obtain single particle sensitivity. Using localized electric fields at the trapping aperture, the Raman integrated trapping setup greatly enhances the optical interaction with the trapped particle enabling the required sensitivity. In this work, the trapping and identification of 20 nm titania and polystyrene nanoparticles is demonstrated.

The second method uses an aperture assisted optical trap to detect the response of a magnetite nanoparticle to a varying applied magnetic field. This information is then used to determine the magnetic susceptibility, remanence, refractive index, and size distribution of the trapped particle.