

**Department of Electrical and Computer  
Engineering  
North South University**



**Senior Project Design  
On Chip Optical Trapping and Sorting**

**Team Members:**

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Summer, 2019

## Declaration

This is to declare that no part of this report or the project has been previously submitted elsewhere for the fulfillment of any other degree or program. Proper acknowledgement has been provided for any material that has been taken from previously published sources in the bibliography section of this report.

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# Approval

The Senior Design Project entitle “On Chip Optical Trapping and Sorting” by Syeda Ramisa Masum, Muhammad Zayan Ahsan, Sayed Hasan Salim and MD Fakrul Hassan has been accepted as satisfactory and approved for partial fulfillment of the requirement of BS in CSE degree program.

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# **Acknowledgement**

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## **Abstract**

In this paper we investigated the effects of Bessel Beam and plane wave separately on three different types of particle. Our research was mainly with particles of chiral, dielectric and plasmonic material on nanometer scale. The particles were observed to have exhibited different behavioral patterns under the effects of said waves when a slanted substrate was placed under each particle. The different behavior of particles were sufficient to sort these particles and also due to the slanted plasmonic sheet it was possible to trap certain types of particles. The incident light for both cases was projected from above with incident angle of 90 degrees. Our work accentuates the impact of tractor beam on optical chip thus sorting dipolar particles. Under the influence of plane wave, our study shows that all the particles behave similarly as all three di-pole objects are getting pulling force and therefore, they are being trapped. But for Bessel beam, which is a non-diffractive, high intensity light, with a cone angle of 20 degree and incident angle of 90 degree; the particles show different behavior. Chiral and Dielectric particles experiences pulling force therefore they are being trapped but plasmonic particle exerts pushing force. This phenomenon allows us to sort unknown particles. The inside physics can be defined with Poynting vector which represents the instantaneous power flow due to instantaneous electric and magnetic fields