

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



**Senior Project Design
All-Optical Sorting and Separation of Rayleigh
Objects from an eight-particle cluster**

Team Members:

Name:

- 1. Musayed Ahmed**
- 2. Musa Talukder**
- 3. MD. AL-AMIN**

ID:

**172 1560 043
171 1755 643
171 3002 643**

Faculty Advisor:

Dr. Mahdy Rahman Chowdhury

Associate Professor

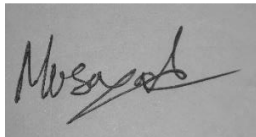
Department of Electrical and Computer Engineering

North South University

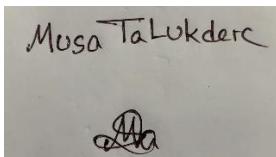
Spring, 2021

Declaration

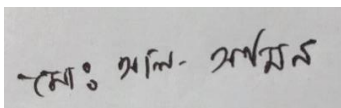
This is to declare that no part of this report or the project has been previously submitted elsewhere for the fulfillment of any other degree or program. Proper acknowledgement has been provided for any material that has been taken from previously published sources in the bibliography section of this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



.....
Musayed Ahmed
Department of Electrical and Computer Engineering
North South University, Bangladesh



.....
Musa Talukder
Department of Electrical and Computer Engineering
North South University, Bangladesh



.....
MD. AL-AMIN
Department of Electrical and Computer Engineering
North South University, Bangladesh

Approval

The Senior Design Project entitled “All-Optical Sorting and Separation of Rayleigh Objects from an eight-particle cluster” by Musayed Ahmed, Musa Talukder and MD. AL-AMIN has been accepted as satisfactory and approved for partial fulfillment of the requirement of BS in EEE degree program.

MAHDY

.....
Supervisor’s Signature

Dr. Mahdy Rahman Chowdhury

Associate Professor

Department of Electrical and Computer Engineering

North South University

Dhaka, Bangladesh.

.....
Dr. Mohammad Rezaul Bari

Associate Professor & Chair

Department of Electrical and Computer Engineering

North South University.

Dhaka, Bangladesh.

Acknowledgement

First of all, we would like to express our profound gratitude to our honorable course instructor, Dr. Mahdy Rahman Chowdhury, for his constant and meticulous supervision, valuable suggestions, his patience and encouragement to complete this research.

We would like to thank everybody who supported us and provided with guidance for the completion of this research.

Abstract:

In this paper we try to sort three different types of particles. Mainly we take 3 types of particles and total particles are 8, all with a radius of 100nm. Those particles are chiral, dielectric and plasmonic material on nanometer scale. We put the particles in two different optical set-ups. After falling light particles showing their characteristics. The incident light for both cases was projected from above with an incident angle of 45 degrees with horizontal x-axis. Under the influence of plane waves, our study shows that some particles are getting pulling force, some particles are pushing force and some particles are getting lateral force. Therefore, they are being trapped. And we can easily find out the particles. The light scattering was 45 degrees. Understanding the sort of particles from an eight particles cluster based on distinctive optical forces has not been detailed so distant. Such an identification of the sorts of diverse particles is called optical sorting. In most of the set ups, optical sorting has been detailed for sweep based sorting of Rayleigh sized single particles. In expansion, the thought of all optical sorting has never been connected to sort and partition Rayleigh objects from a blend of particles. In this report, two distinctive optical setups have been proposed. Enlightened by a directly polarized plane wave in a molecule cluster developed with chiral, plasmatic, and dielectric nanoparticles in an air medium (optical set-up 1), half drenched in water (optical set-up 2). At to begin with, by shifting the light wavelengths, we have appeared that optical sorting isn't conceivable for eight particles cluster when they are put oppositely beneath the light. Afterward, in the same molecule cluster in all setups light was illuminated at an angle of $\theta = 40$ along the +X axis. By varying the wavelength of the light, it has been observed that the dielectric get counter-intuitive pulling constrain because of the current density of the nearby plasmonic particle changing from chaotic to linear state, plasmonic getting pushing constrain due to the transferred momentum of photon and chiral get lateral drive mainly due to the induced magnetic dipole on the chiral nanoparticle. Such optical sorting by utilizing three totally diverse strengths without using any chemical may open a totally novel way for molecule discovery, accumulation and the organization of layouts for organic and colloidal science within the close future.