

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



**EEE 499
Senior Project Design**

**Dielectric and Plasmonic Dimers: Broadband Reversal of
Optical Binding Force**

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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 “Dielectric and Plasmonic Dimers: Broadband Reversal of Optical Binding Force” by Md. Mahadul Islam (ID: 1620871043) and Md. Mizanur Rahman (ID: 1620306043) has been accepted as satisfactory and approved for partial fulfillment of the requirement of BS in EEE degree program.

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ABSTRACT

The controlled broadband reversal of optical binding force is one of the latest and most promising areas of optical manipulation. Hardly any work has been done to control broadband reversal of optical binding force of two heterodimers. Until now, optical manipulation has been used to find the reversal at the far field optical binding force for plasmonic homodimers only. The behavior between the dielectric-plasmonic nanoparticles and their optical binding force in near and far fields have not been investigated in the literature yet as the regulation of optical binding force by using only light in both far field and near field is completely an ascending area. In this article, we have shown a very simple way of controlling the broadband reversal of optical binding force in both near field and far field for dielectric and plasmonic heterodimers. Through five different setups, we have shown that strong and stable reversal can be achieved for the near field binding force for the dielectric-plasmonic heterodimers only if we put them on a substrate made of plasmonic material in an inhomogeneous background (air). This kind of reversals of binding force for dielectric-plasmonic heterodimers have been demonstrated based on the change in electric field and dipolar theory. Thus, we have proposed two generic ways to achieve strong reversal of optical binding force for dielectric-plasmonic heterodimers on a plasmonic made substrate, where we can control the mutual attraction and repulsion by varying the wavelengths only. Keywords - broadband reversal, optical manipulation, dielectric, plasmonic, heterodimers, dipolar theory.