

## Physics Department Senior Design Project Proposal

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Project Title: Light-Controlled Superhydrophobic Surfaces

Project Type: [ x ] Team; Number of students: 2 [ ] Honors

### Objective

Azobenzene-based molecular monolayers exhibit light-driven mechanical orientation changes. This phenomenon is the basis for patterned and active control of wetting, which can be used to move small droplets, oligomers, and cells on a surface. The effect is expected to be particularly prominent when the azobenzene layers are applied to rough surfaces, such as an array of zinc oxide nanorods. This project will explore different ways of accomplishing this, using readily available and easily modified materials. The objective will be to create micro-scale chemical reactions through drop manipulation, and to explore the possibility of controlling surface movement of living cells.

### Prior Background

Our group has extensive experience with photoactive molecular layers and ZnO nanostructures, and is currently working with similar systems for liquid crystal alignment and polymer photovoltaics. Several students in the group have recent knowledge of how to handle these materials.

### Student Expectations

Students will fabricate ZnO nanorod arrays, and attach azobenzene-based monolayers to these surfaces using several different methods. These surfaces will be characterized using contact angle tests and optical absorption spectroscopy. The deliverable is progress toward a light-controlled water contact angle, during active illumination of a drop by the end of the first semester with optimization of the effect by the end of the second semester.

### Supervision Plan

Day to day supervision will be coordinated with a senior grad student. Students will meet as a team with Prof. Furtak once a week.

### Resources

All necessary materials and hardware are in place. Expendables will be provided by a grant, sponsored by the National Science Foundation.

### Technical References

N. Verplanck, Y. Coffinier, V. Thomy, and R. Boukherroub, "Wettability switching techniques on superhydrophobic surfaces", *Nanoscale Research Letters* **2**, 577 (2007).

K. Ichimura, O. Sang-Keun, and M. Nakagawa, "Light-driven motion of liquids on a photoresponsive surface," *Science* **288**, 1624 (2000).