

# PHYSICAL MATHEMATICS SEMINAR

## Information processing by artificial and natural receptor arrays

**DAVID ZWICKER**

Harvard University

### ABSTRACT:

The sense of smell is little understood because the complexity of chemical space is an experimental and theoretical challenge. For instance, how can relatively few olfactory receptors discriminate between the vast number of possible odor mixtures? We approach this question theoretically by discussing design principles of optimal receptor arrays. In this talk, I will present a mathematical model of such arrays and show how they can maximize the encoded information. Such maximum entropy arrays are appropriate in technical applications, but their dense codes are difficult to process by the brain. Instead, natural systems employ sparse codes generated by a global inhibition mechanism, which allows to separate the odor composition from its intensity. I will show that a simple model of this situation implies that odors with many molecular species are more difficult to discriminate and that arrays with very heterogeneous receptors perform worse. Generally, these models connect the microscopic information of receptor sensitivities to psycho-physical quantities and can thus be used to better understand natural olfaction and artificial counterparts.

**TUESDAY, APRIL 25, 2017**

**2:30 PM**

**Building 2, Room 147**

*Reception following in Building 2, Room 290  
(Math Dept. Common Room)*

<http://math.mit.edu/seminars/pms/>