



JOHNS HOPKINS  
BLOOMBERG  
SCHOOL of PUBLIC HEALTH

*Department of Biostatistics*

# BIostatistics SEMINAR

## Modeling Cross-Oscillatory Interactions with Applications to Multivariate Brain Signals

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The brain science community is keenly interested in studying how neurons and neuronal populations interact while processing complex cognitive tasks. In fact, there is a growing body of evidence suggesting that altered brain functional connectivity may be associated with various mental and neurological disorders. Motivated by these important problems, our group has been developing statistical models for studying cross-oscillatory dependence between components of a multivariate time series. These models explain how dependence between components in a network may change across experimental conditions and patient groups.

The classical approach to characterizing cross-oscillatory dependence between channels is coherence analysis. The main limitation of this approach is that is confined to capturing dependence between oscillations at only the same frequency band. To overcome this serious limitation, we are developing new approaches to modeling dependence between oscillations at different frequency bands (e.g., between theta oscillations in one channel and gamma oscillations in another). In this talk, we first present an exploratory analysis of local field potential data from a macaque monkey. To study dependence between oscillations, we propose a vector-autoregressive model of the band-specific time-segmented Fourier periodograms. Next, we propose a unified framework, based on harmonizable processes, under which we can rigorously approach scientific questions on lead-lag oscillatory interactions between components in a network.

This is a joint work with members of the Space-Time Modeling Group at UC Irvine and with our brain science collaborators (E. Eskandar at MGH, D. Moorman at MUSC, D. Dickstein at Brown and S. Cramer at UCI).

**The Johns Hopkins Bloomberg School of Public Health  
Department of Biostatistics, Monday, October 21, 2013, 12:15-1:15pm  
Room W4030, School of Public Health (Refreshments: 12:00)**

**We request that lunch be eaten before or after seminar and not during the seminar**

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