Shella D. Keilholz, PhD
Professor
Biomedical Engineering

*Learning Brain States from Resting State fMRI*

Shella D. Keilholz received her B.S. degree in physics from the University of Missouri Rolla (now Missouri University of Science and Technology) and her Ph.D. degree in engineering physics at the University in Virginia. Her thesis focused on quantitative measurements of perfusion with arterial spin labeling MRI. After graduation, she went to Dr. Alan Koretsky's lab at the NIH as a Postdoctoral Researcher to learn functional neuroimaging. She is currently a Professor in the joint Emory/Georgia Tech Biomedical Engineering Department, Atlanta, GA, USA and Program Director for the 9.4 T MRI. Her research seeks to elucidate the neurophysiological processes that underlie the BOLD signal and develop analytical techniques that leverage spatial and temporal information to separate contributions from different sources.

Abstract: Resting state fMRI captures intrinsic activity across the whole brain, which is typically summarized into functional networks using time-averaged metrics like correlation. To gain a deeper understanding of how intrinsic macroscale activity both arises from and constrains local neural activity, we must move beyond time-averaged metrics to new methods that can characterize the complex dynamics of brain activity. Using tools from machine learning, we show that brain activity can be described in terms of states and trajectories, with features that are common across individuals. Moreover, we can use machine learning to identify the best generative models of brain activity along with their parameterizations. The ability to synchronize these models with measured resting state fMRI data opens up new possibilities in terms of model validation, and paves the way for individualized models of brain function that can be used for personalized treatment of neurological and psychiatric disorders.

Emory Univeristy and Georgia Tech