AbstractID: 7846 Title: Parallel Magnetic Resonance Imaging (or, scanners, cell phones, and the surprising guises of modern tomography)

Today, parallel data acquisition approaches are used widely in MRI, both for clinical diagnostic imaging and for research applications. Whereas in a traditional sequential MRI scan, data are collected one point and one line at a time in the presence of varying magnetic field gradients, parallel MRI uses spatial information from arrays of radiofrequency detector coils to acquire multiple data points simultaneously, thereby circumventing basic limits on imaging speed and efficiency associated with traditional sequential approaches. The use of RF coil information in combination with the traditional Fourier information available from field gradients increases the complexity of image reconstruction. In fact, parallel MR image reconstruction may be represented as a generalized linear inverse problem. This formulation highlights connections with other modalities as well as shedding light on both the potential and the limitations of parallel imaging. In this talk, the fundamentals of parallel MR image acquisition and reconstruction will be reviewed. Analogies with X-ray computed tomography, MIMO wireless communication, and magnetoencephalography will be explored, and some future directions in parallel MR reconstruction algorithms, hardware design, and clinical applications will be surveyed.

Educational objectives:

1. Understand the basic physical principles of parallel MR data acquisition and the basic mathematical principles of parallel MR image reconstruction.
2. Recognize analogies with other imaging modalities and communication technologies.
3. Identify fundamental physical (electrodynamic) limits of performance of parallel MRI systems.
4. Appreciate some of the most common current and the most promising future clinical applications of parallel MRI.