***Imaging Acquisition & Reconstruction* / Non-Cartesian k-Space Sampling**

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Highlights: This talk will present the benefits and drawbacks of Non-Cartesian k-space sampling. Examples of such trajectories include spiral, projection reconstruction, VIPR, stack of spirals, stack of stars, stack of cones, and many, many more. EPI trajectories, which could be considered post-Cartesian, will not be considered in this work. The benefits and drawbacks of these trajectories are listed below. However, because the class of Non-Cartesian sampling trajectories is large and varied, each positive or negative trait does not apply to each example.

Target Audience: Anyone wishing to understand the benefits, drawbacks, and implementation details of Non-Cartesian sampling strategies in MRI, particularly those attempting to implement them.

Benefits of Non-Cartesian Sampling: Alternate Trajectories provide a great deal of flexibility in collecting MRI data; they can reduce motion artifacts through lower gradient moments and less coherent expression of those artifacts, they can reduce the coherence of aliasing artifacts, they can be used flexibly in temporal applications, they can be used for very short TE's, and they are generally more efficient than standard trajectories. For fast imaging, non-Cartesian sampling), give the potential of shortening scan time **while maintaining, or even increasing, image SNR** without fitting the data to an apriori model. Importantly, they are also compatible with, and sometimes optimal for, sparse-data approaches such as compressed sensing.

Drawbacks of Non-Cartesian Sampling: A "sampling trajectory" in k-space reflects a known, applied phase to the spins of interest, which is used to encode position. Phase accrual in the spins from other magnetic fields not accounted for, such as susceptibility-induced B0 changes, eddy currents, and concomitant fields, corrupt that spatial encoding. These effects must be known or measured, and accounted for in the subsequent reconstruction, in order to obtain an accurate image. A second drawback of these methods is reconstruction time. Reconstruction of images from "fully sampled" data sets acquired using non-Cartesian sampling trajectories is well-understood and basically a "solved" problem, however parallel imaging, compressed sensing, and other constrained reconstruction methods with these methods tend to (a) be approximate and (b) require more computation than standard Cartesian methods.