Contribution ID: **1429** Type: **Invited Speaker / Conférencier invité**

Magnet and Radiofrequency Technology for Low Cost Magnetic Resonance Imaging

Tuesday 14 June 2016 08:30 (30 minutes)

MRI is a highly effective, but expensive imaging modality. Lower strength magnetic field and lower cost variants of MRI are being developed for specific applications. We will focus on one approach, 'Transmit Array Spatial Encoding'(TRASE), which uses only a resonant radiofrequency (RF) field to produce Fourier spatial encoding equivalent to conventional MRI. The usual audio frequency switched magnetic field gradient coils are not needed. We will review different magnet experimental configurations and the MHz RF technology needed to implement these low-cost MRI experiments. High-resolution two-dimensional-encoded in vivo MR images of hand and wrist have been obtained using a uniform 0.2T main magnetic field (B0). An alternative approach is to use an inhomogeneous but very low cost main magnet, in combination with the RF-based image encoding. The mechanism used by TRASE exploits RF field phase gradients to encode image information into echo train NMR pulse sequences. The RF transmit field must be designed to produce these phase gradients, but also must be changed between RF pulses. This can be achieved by multichannel transmitters, or by RF switching, or a combination of approaches. In addition to the low cost advantage, novel experiments exploiting unique capabilities, such as imaging without disturbance of the main B0 magnetic field are possible.

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Session Classification: T1-1 Medical Imaging (DPMB) / Imagerie médicale (DPMB)

Track Classification: Physics in Medicine and Biology / Physique en médecine et en biologie (DPMB-DPMB)