Dielectric Resonators for MR Microscopy at 21.1 T

2009 NHMFL Science Highlight for NSF

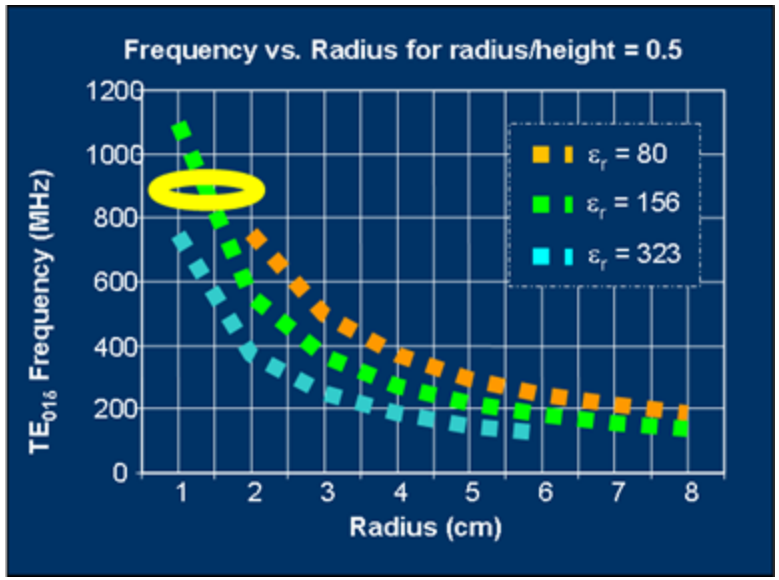
DMR-Award 0654118

NMR Spectroscopy and Imaging User Program, Florida State University

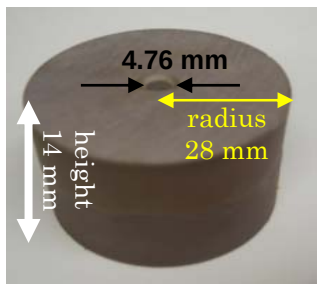
User Collaboration Grants Program (UCGP)
- **SC Grant, Chemical & Biomedical Eng, FSU**
- **AG Webb, Bioengineering, Penn State U.**

Dielectric resonators (DRs) -- compact magnetic field storage devices that typically operate in the GHz range -- are a promising new technology for high-field magnetic resonance (MR) probes. *In fact, the higher the frequency, the more compact the DR and easier the manufacturing (e.g. see 900 MHz in the top figure).* The use of high permittivity, low loss materials yields DRs with Q values much greater than 1000, which translate to higher signal-to-noise ratios for MR applications.

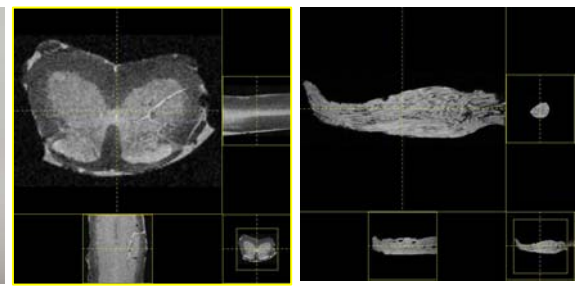
These DRs have outperformed similarly sized copper coils for MR applications at 900 MHz (21.1 T) with respect to sensitivity & RF homogeneity.



DR resonance is tuned using permittivity & dimensions



21.1-T $CaTiO_3$ DR



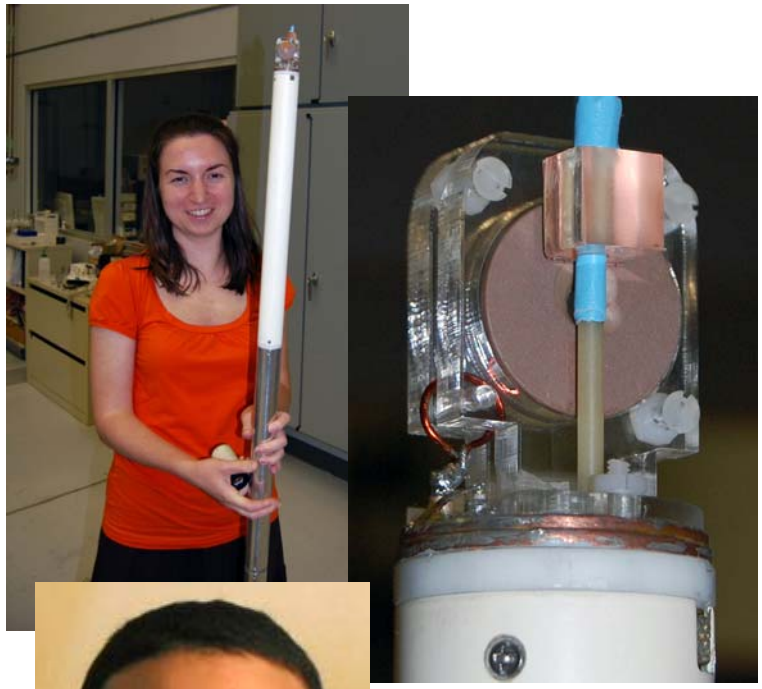
30-μm 3D MR images of excised mouse spinal cord (L) & rat muscle

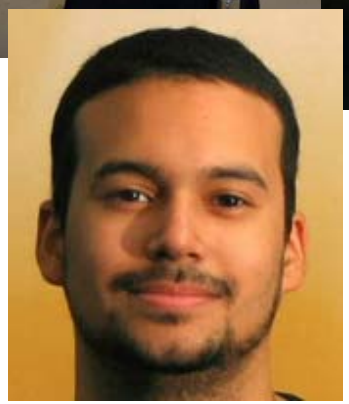
Dielectric Resonators for MR Microscopy at 21.1 T

2009 NHMFL Science Highlight for NSF

DMR-Award 0654118

NMR Spectroscopy and Imaging User Program, Florida State University

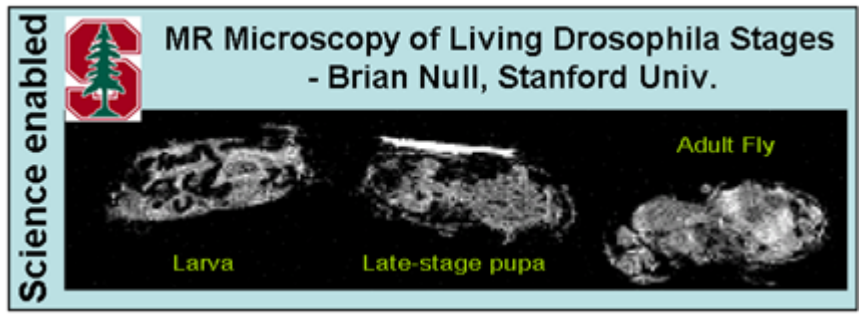




Graduate students Kristina Haines (PSU) & Jose Muñiz (FSU) and their work are supported by the UCGP & NHMFL

User Collaboration Grants Program (UCGP)
- **SC Grant, Chemical & Biomedical Eng, FSU**
- **AG Webb, Bioengineering, Penn State U.**

• Two graduate students at Pennsylvania and Florida State Universities (see left).
• 900-MHz dielectric resonance coils have been used by external collaborators from Stanford Univ. and the University of Leiden Medical Centre, Netherlands.



Based on success at 21.1 T, these DRs will be extended to the 25-T Keck resistive magnet. Also, future implementation for high field solid-state NMR may offer interesting synergistic enhancements.