UNIVERSITY OF MINNESOTA
Driven to Discover℠

Utilizing periodic irradiation to enhance sensitivity of magnetic resonance detection

A periodic irradiation method for measuring exchange-induced relaxation rate constants to characterize tissue properties using MR spectroscopy.

IP Status: US Patent Issued #11,474,174

Applications

- Medical imaging - studying chemical shift differences, protein dynamics and conducting MR imaging and spectroscopy investigations in living samples
- CEST MRI

Overview

Chemical exchange saturation transfer (CEST) is an emerging magnetic resonance technique that is viewed as a better and safer alternative to PET. CEST imaging has been demonstrated in mapping low-concentration metabolites such as creatine, glucose, glutamate, and changes in microenvironment properties such as temperature and pH, promising a host of in vivo application such as imaging of ischemic stroke and tumor. However, CEST MRI suffers from several limitations including long imaging time, and the qualitative nature of the contrast, which depends on chemical exchange rate, concentration of exchangeable protons, longitudinal relaxation time, and RF saturation power. Additionally, CEST imaging has a high specific absorption rate (SAR), and is highly sensitive to the magnetic field (B0).

Researchers from the University of Minnesota, the University of Eastern Finland, and the University of Oulu have developed a method for enhancing sensitivity of MR to probe exchanging systems using periodic radiofrequency (RF) irradiation. In this method, by applying periodic RF pulse sequences to a region of interest, off resonance sidebands are generated, which significantly amplifies the exchange - induced relaxation rate constants when the system is in the intermediate or slow exchange regime. This enables them to enhance specific relaxation rate constants induced by exchange by altering the irradiation periods of the pulses. This feature could be used for more precise determination of the MR fundamental parameters of the sample by sequentially incrementing frequency of RF irradiation. In addition, unlike chemical exchange saturation transfer (CEST) technique, which is used for mapping low-concentration metabolites such as creatine, glucose, glutamate, and changes in microenvironment properties such as temperature and pH, the novel method has several technological advancements. Periodic RF irradiation results do not depend on accurate measurements of magnetic field (B0) strength, thereby limiting the variability of the imaging, and require less power deposition to the living sample (less SAR).

Key Benefits & Differentiators

Technology ID
20180384

Category
Engineering & Physical Sciences/MRI & Spectroscopy
Life Sciences/MRI & Spectroscopy

Learn more

- Does not require radioactive tracers (unlike PET scans)
- Significantly reduced sensitivity to B0 strength
- 3x to 5x more sensitive than CEST
- Faster acquisition than CEST as two opposite spectral location measurements are not required
- Uses low magnetic field strengths, therefore reduces SAR

Desired Partnerships

This technology is now available for:

- License
- Sponsored research
- Co-development

Please contact our office to share your business' needs and learn more.

Researchers

- **Shalom Michaeli, PhD** Professor, Center for Magnetic Resonance Research, Radiology
- **Silvia Mangia, PhD** Professor, Department of Radiology
- **Timo Liimatainen, PhD** Professor, Medical Imaging, University of Oulu
- **Hanne Laakso, PhD** Professor, University of Eastern Finland

References

1. Liimatainen, Timo, Hanne Laakso, Djaudat Idiyatullin, Silvia Mangia, and Shalom Michaeli. , https://doi.org/10.1016/j.jmr.2018.09.001