Investigation of Neodymium-iron-boron Magnet Arrays for Possible Use in Magnetic Resonance Teaching Applications

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Background: Desktop nuclear magnetic Resonance (NMR) units are useful for introducing students in a variety of disciplines to fundamental aspects of magnetic resonance. They also are useful for some research purposes. A significant portion of the cost, size and weight of desktop NMR units is the magnet. The configuration of the magnet design, including field gap size, shape, and magnetic field flux density, may place unneeded constraints upon experimenters and researchers who use iron permanent magnets or iron core electromagnets.

Objective: The research goal was to devise lighter weight, more compact, and less expensive alternative magnet systems for desktop magnetic resonance systems.

Methods: Arrays of low cost and versatile neodymium-iron-boron magnets both without and with iron or steel backing were studied by making Hall probe gauss meter measurements. Theoretical calculations of field flux density at individual points and computer generated field line plots were made using commercial software.

Results: Flux densities from 0.1 to 0.6 Tesla were obtained using low cost and light weight arrays of these magnets. Some arrays gave noticeably better field homogeneity than others as determined by directional field flux density plots.

Conclusion: Neodymiun-iron-boron magnet arrays show promise for greater use in desktop magnetic resonance applications.

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