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A Concept for Direct MRI using Diamonds with Nitrogen Vacancies

Magnetic Resonance Imaging (MRI) is currently achieved by preparing a distribution of phases into the magnetization of the object you want to image. An MRI signal point is then the integration of the magnetization from the object. Many of these spatially encoded signal points are required which are then subsequently Fourier transformed into an image. The many measurements required for this process makes the MRI imaging process slow. However, an object with unencoded magnetization produces a magnetization field in the space surrounding it. Using small sensitive magnetometers, made with Diamonds with Nitrogen Vacancies, we could measure that field and infer the distribution of the magnetization in the object we want to image by solving the inverse problem. The inverse problem is generally ill-posed but the severity of that ill-posed-ness might be reduced with an appropriate distribution of the magnetometers. With that design and an appropriate inverse problem based image reconstruction, instantaneous MRI with only one measurement becomes conceivable and we'd have an MRI version of fluoroscopy.