Soliton Resonance Imaging (SRI) as Low-Cost Alternative to MRI

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Introduction

Magnetic Resonance Imaging, although it is considered to have no known medical side-effects provided that contrast materials are not used, suffers from poor contrast relative to Computed Tomography (CT) and high financial cost. There is an appetite for both technically superior novel imaging techniques, especially those that can be provided at lower cost than MRI. The high per-unit cost of MRI machines as well as the high cost associated with cooling the machines is a deterrent to use that causes hospitals to favor the use of Computed Tomography (CT) imaging; which employs potentially harmful X-Ray radiation; despite MRI's availability. SRI, if developed, may come to supplant both CT and MRI.

Abstract

To understand the SRI concept, one needs to first understand MRI. When even non-ferromagnetic compounds such as water are exposed to magnetic pulses of sufficient magnitude, the electron clouds of the affected atoms emit Radio Frequency radiation as a result of a form of spontaneous emission of EM stemming from the electrons orbiting individual atoms briefly but abruptly closing distance i.e. moving into a higher energy state before re-assuming their original energy state. MRI machines employ radio detectors to estimate the point of origin of these spontaneous emission radio waves, which are more intense the greater the density of the detected material. MRI cannot necessarily identify specific chemical compounds and although MRI is capable producing three-dimensional images, the resolution of these images averages about 1 millimeter per pixel; nowhere near atomic resolution.

Any influence that can force electrons orbiting an atom to increase their proximity to one another, even without a change in energy state, can result in the spontaneous emission of EM ranging from RF to visible light and beyond. While such a result can be achieved by generating extreme magnetic fields, this is far from the most efficient means. One predicted effect of soliton waves on electron clouds is a phenomenon this author terms "hemispheric parting." Hemispheric parting, in addition to having application for increasing the likelihood of microwave resonances for confectionary applications where fast cooking is desired, may have a secondary effect that is useful in the field of diagnostic imaging.

"Hemispheric parting" may be defined as the momentary derangement of all electrons in an electron cloud of an atom amounting to the totality of the electrons being pushed into a single hemisphere, resulting in the total absence of electrons in the opposing hemisphere. It is the belief of this author that soliton waves are capable of producing this effect, however briefly. Just as electrons jumping between higher and lower orbits can produce spontaneous EM emissions, hemispheric parting should produce the same effect with far less effort.

Benefits Versus Current Methods

SRI has as another of its benefits that RF emissions may be more precisely triangulated by consideration of time-of-flight analysis of the soliton wave(s), which would take some small amount of time to pass through the body. Not only does this open up the potential for resolutions more granular than 1mm/pixel, but the possibility of atomic-scale resolution, and with it, precise in-vivo chemical identification. This has application for both the detection of not only specific chemical compounds, but the extrapolation genetic information found in cancers, bacteria, virii, or human DNA. The ability to sequence the DNA of satellite tumors in advanced metastatic cancers may prove critical as tailored therapies are often dependent upon this data; data which cannot be obtained when it is impractical to retrieve samples from areas deep within the body considered inoperable. An effective atomic-scale resolution imaging technology would bring with it the ability to perform screenings for all possible toxins and not merely for common compounds.

Method of Generation

Soliton waves may be generated by transmogrification of classical electromagnetism via passage of that EM through a ring of electromagnets of alternating polarity. The transformed EM would consist of flat, pancake-like two-dimensional walls of energy moving flat-side-first through space. These flat bodies of energy would consist of electrons spinning in opposing directions in each of perhaps a dozen or more "pie slices." Slice A would consist of forward-spinning electrons while Slice B would consist of back-spinning electrons. These opposing rotations allow the wave to travel through ordinarily-resonant materials such as water with a lesser chance of resonance since the constituent electrons of the wave generate a constant magnetic repulsion. While resonances sc. Electromagnetism striking the nucleus of an atom resulting in heating are far less likely in soliton-structured EM, the electron clouds of any material the wave passes through are perturbed to a much greater degree than they would be by classical EM. The predicted behavior is the aforementioned hemispheric parting in which electrons are momentarily swept up in the soliton wave and carried to the far side of their associated nuclei, creating an imbalance that is corrected on a timescale on the order of picoseconds.

Conclusion

Soliton-Induced Spontaneous Emission is a promising theoretical avenue for energy-efficient, high-precision in-vivo imaging. Factors such as cost, energy-efficiency, and resolution recommend SRI as a technology worthy of further investigation.

More broadly, soliton waves have application for microwave cooking, secure, high-speed satellite communication, space-based submarine detection, subterranean imaging, and stealth defeat.