

ment that “Soljačić and his MIT colleagues are now working on demonstrating the technology in practice.” I strongly recommend that they consult with the MIT Radio Society and the Federal Communications Commission (FCC) before testing anything, since simple calculations show that their system would be a terrible and illegal electromagnetic polluter.

The system proposed by the researchers uses conducting wire rings that are series-resonated with capacitors and that operate at a frequency of 6.4 MHz. Practical examples of these resonated rings for 7.0 MHz are sold by various vendors.

The proposed system provides 4 watts of output from the receiving ring, at a cost of 11 W dissipated as heat in the transmitting ring and 1.5 W of power radiated from the system. Simple calculation shows that the 1.5 W exceeds the FCC’s radiated-emission power limit by a factor of 800 000.

As most amateur radio operators know, 1.5 W of radiated power at 7.0 MHz is enough for worldwide radio communications under good conditions, and indeed some of the resonated rings available for purchase are marketed as radio antennas.

The 3- to 30-MHz frequency range is intensively used for long-distance radio communications and broadcasting even today, because it is the only channel that provides long-distance communications with no transmission infrastructure at all.

I consider it deeply unwise to pollute this unique channel for the sake of short-range systems.

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I was somewhat bewildered by the “Unwired Energy” Physics Update.

Energy transfer using electromagnetic resonance is used today in thousands of locations around the world—door locks, toll roads, and many more upcoming applications such as airport luggage tracing and supermarket checkouts. All RFID (radio-frequency identification) tags are powered with LC resonant circuits.

Actually, nearly 50 years ago, when I was in primary school, I built a diode radio receiver that drew operating energy from a circuit tuned to a radio-station frequency. A diode was used to detect the signal that drove an earphone. No battery was involved.

I don’t think the MIT work is really new physics but rather an attempt at improved engineering for, say, transferring sufficient energy to drive laptops.

Radiating hundreds of watts of RF in a room or several thousand watts in a coffee shop seems to me to be too risky for people and will not be accepted.

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Karalis, Kurs, Joannopoulos, and Soljačić reply: The results presented in our theoretical work¹ are relatively simple examples of how to implement our proposed scheme for wireless energy transfer. In practice, the system could be designed to operate at frequencies outside the ham radio band, to perform much better than Peter Anderson states (see, for example, section 4 of reference 1) by improving on the materials and geometries used, and to radiate below general safety and interference limits—for example, the IEEE (Institute of Electrical and Electronics Engineers, Inc) standards for general public exposure.² Safety and interference issues are very important and will have to be thoroughly investigated before any product development.

The physics of electromagnetic resonance and its use for transferring energy wirelessly has long been known and used to provide relatively low levels of power to various applications, as Herzel Laor states. Existing resonant-electromagnetic-induction technology has been inadequate to efficiently power, over mid-range distances, devices that require on the order of tens of watts of power or more. Our work demonstrates that it is the physics of strong coupling, for which resonance is a prerequisite, that enables the efficient wireless energy transfer needed for larger power applications.¹ The principles of this physical concept will certainly lead to improved engineering in designing actual systems.

In addition, strong coupling implies that the scheme is not radiative but rather uses the near stationary field; therefore, “hundreds of watts of RF” are *not* being radiated by our method, as numerical examples in reference 1 demonstrate.

References

1. A. Karalis, J. D. Joannopoulos, M. Soljačić, *Ann. Phys.* (in press); preprint at <http://arxiv.org/abs/physics/0611063>.
2. For a detailed analysis, see the supporting online material with A. Kurs, A. Karalis, R. Moffatt, J. D. Joannopoulos, P. Fisher, M. Soljačić, *Science* 317, 83 (2007).

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