

# 1 Wireless Power Transfer - it is Real!

I BELIEVE EVERYBODY WAS HAPPY when we were able to get rid of all the phone and Ethernet cable and connect to the Internet using WiFi. But we still need to plug in all our electronic devices to charge their batteries. And with all of them having different adaptors, connectors, voltage levels, etc., they create a big mess around us. The dream for wireless power transfer is not something new.

A team from MIT's Department of Physics, Department of Electrical Engineering and Computer Science, and Institute for Soldier Nanotechnologies (ISN) has experimentally demonstrated an important step toward accomplishing this vision of the future.

The team was led by Prof. Marin Soljacic. Realizing their recent theoretical prediction, they were able to light a 60W light bulb from a power source seven feet (more than two meters) away; there was no physical connection between the source and the appliance. The MIT team refers to it as "WiTricity" (as in wireless electricity).

Various methods of transmitting power wirelessly

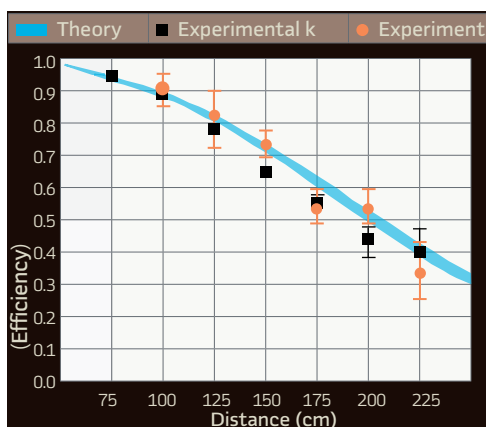
have been known for centuries. Perhaps the best known example is electromagnetic radiation, such as radio waves. While such radiation is excellent for wireless transmission of information, it is not feasible to use it for power transmission. Since radiation spreads in all directions, a vast majority of power would end up wasted into space.

WiTricity is based on using coupled resonant objects. Two resonant objects of the same resonant frequency tend to exchange energy efficiently, while interacting weakly with off-resonant objects. The MIT team focused on magnetically coupled resonators. The team explored a system of two electromagnetic resonators coupled mostly through their magnetic fields. They were able to identify strongly coupled regime in this system, even when the distance between them was several times larger than the sizes of the resonant objects, thus enabling efficient power transfer ■

For more information go to <http://web.mit.edu/newsoffice/2007/wireless-0607.html>

*The team members are Andre Kurs, Aristeidis Karalis, Robert Moffatt, Prof. Peter Fisher, and Prof. John Joannopoulos (Francis Wright Davis Chair and director of ISN), led by Prof. Marin Soljacic.*

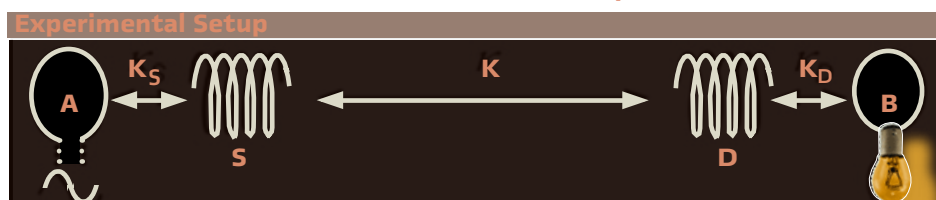
Magnetic coupling is particularly suitable for everyday applications because most common materials interact only very weakly with magnetic fields



Wireless Power Curve



Wireless power transfer demonstration



*Details on the principles and setup are available at: <http://www.sciencemag.org>*

## 2 Impact of Sun Storms on GPS based devices

**The impact of sun** storms on electric power grids has been subject to many papers, articles and reports during the last two decades. System disturbances caused by solar activity can disrupt complex power grids due to the geomagnetically induced currents (GIC) resulting from the interaction of the Earth's magnetic field and ionized particles carried by the solar wind. Severe magnetic storms induce electric fields in the Earth that create potential differences in voltage between grounding points and causes GICs to flow through transformers, power system lines, and grounding points.

The appearance of a spot (an area of highly organised magnetic activity) on the surface of the Sun that produced two solar blasts in January 2008 signalled to scientists around the world

the beginning of a new solar cycle - 'Cycle 24'. Each solar cycle lasts an average of 11.1 years. This cycle is expected to build gradually, with the number of sunspots and solar storms reaching a maximum by 2011 or 2012. However, intense solar activity can occur at any time. More information on this new cycle is available at: [http://www.esa.int/esaCP/SEMT1J3MDAF\\_index\\_0.html](http://www.esa.int/esaCP/SEMT1J3MDAF_index_0.html)

The impact of solar activity on the power grid is not the only concern for protection specialists. The last few years have seen a significant increase in the interest and use of synchrophasors. The wide acceptance of IEC 61850 and the benefits of process bus will lead to the replacement of copper analog circuits with fiber cables transmitting sampled analog values. Both technologies require time synchronization



**Composite Sun Flare Image: courtesy of NASA**

with accuracy better than 1 microsecond. Time synchronization of different intelligent electronic devices (IEDs) in substations is based on GPS signals. The concern regarding the impact of solar activity on time synchronization of substation devices is based on the fact that a solar flare creates radio bursts that traveled to the Earth, covering a broad frequency range, affecting GPS and other navigational systems. The radio waves act as noise over these frequencies, including those used by GPS and other navigational systems that can degrade a

signal. Several major events of such nature have already occurred. For example the satellite-based GPS was seriously disrupted in December 2006 by a solar storm. The unexpected solar radio burst on December 6 affected nearly all GPS receivers on the lighted half of the Earth. The impact of GPS systems failure on the performance of critical electric power systems protection and control functions needs to be studied and well understood in order to determine if any changes in the design of devices with time synchronization are required ■

See: <http://www.noaanews.noaa.gov/stories2007/s2831.htm>.

Image courtesy of NASA



**Artist Interpretation of GPS satellite**

## 3 Microsoft "Surface" Puts People in Control

Imagine being able to place a relay on your desk, and the desk suddenly comes alive, pops-up the settings of the distance zones, shows the loading of the transmission line it is installed on and the apparent impedance seen by the relay, while at the same time your colleague is looking at the COMTRADE file from the latest relay operation. This and much more will be soon possible with the recently announced Microsoft Surface.

*"With Surface, we are creating more intuitive ways for people to interact with technology,"* CEO Steve Ballmer said. It is designed to put people in control of their experiences with technology, making everyday tasks enjoyable and efficient.

Microsoft Surface provides an intuitive user interface that works without a traditional mouse or keyboard, allowing people to interact with content and information on their own or collaboratively with their co-workers, just like in the real world. Surface is a 30-inch display in a table-like form factor that small groups can use at the same time. It also features the ability to recognize physical objects that have identification tags similar to bar codes. When a user simply sets a device on the surface of a table, the system could provide information about the object they are using, the tools that can be used with it, its configuration or maintenance history, the devices it is communicating with and a lot more.. The experience could become completely immersive, letting users access information on similar products, the state of the system and the potential need for adjustments or change of setting groups or a virtual test of the relay under the system conditions combined with a pre-defined type of fault at a location you just pointed your finger to on the system one-line diagram. Surface computing, features four key attributes:

■ **Direct interaction.** Users can actually "grab" digital information with their hands, interacting



*Surface computing recognizes points of contact.*



*Microsoft Surface is designed as a 30-inch table like display.*

To share your ideas about what we can do with Surface, please send an e-mail to: [editor@pacw.org](mailto:editor@pacw.org)

with content by touch and gesture, without the use of a mouse or keyboard.

■ **Multi-touch.** Surface computing recognizes many points of contact simultaneously, not just from one finger like a typical touch-screen, but up to dozens of items at once

■ **Multi-user.** The horizontal form factor makes it easy for several people to gather around surface computers together, providing a collaborative, face-to-face computing experience

■ **Object recognition.** Users can place physical objects on the surface to trigger responses, including the transfer of digital content

Surface computing at Microsoft is an outgrowth of a collaborative effort between the Microsoft Hardware and Microsoft Research teams, which were struck by the opportunity to create technology that would bridge the physical and virtual worlds. What has started as a high-level concept has grown into a prototype and evolved to today's market-ready product that will transform the way people work and live. It's a major advancement that moves beyond the traditional user interface to a more natural way of interacting with devices and information and can revolutionize the PAC world as well. ■

Microsoft Surface creates a new environment that allows the development of a new range of power system engineering tools and applications