

## Popular Summary of Patents

Steven M. Anlage

QMC and Physics Department, University of Maryland

8. US Patent # 11,764,832: Lei Chen; Steven Mark Anlage; Tsampikos Kottos

### **“Systems, Methods, and Media for Wireless Power Transfer”**

This wireless power transfer (WPT) method uses a novel method to efficiently deliver electromagnetic energy to an object in a reverberant enclosure. The method can transfer 100% of the wave energy injected into an enclosed space to objects inside that space, with no energy lost to reflection or transmission. We do this using the mathematical properties of the measured scattering environment. We can create these conditions at essentially any frequency using tunable metasurfaces on the walls of the enclosure, for example. This method can be used to improve the efficiency of microwave heating by allowing a large number of microwave generators to feed energy into a reactor with near-perfect efficiency, and no damaging interactions between the generators.

7. US Patent #11,101,915: Steven Mark Anlage, Frank Cangialosi, Tyler Grover, Scott Roman, Andrew Simon, Liangcheng Tao

### **“System and method for wireless power transfer using time reversed electromagnetic wave propagation”**

We invented a method to deliver power to a moving target using electromagnetic time reversal. It will find applications in wireless electrical transmission to portable devices, wireless heating of portable devices, novel wirelessly powered accelerometers, hyperthermic treatment of cancers, and many other applications.

6. US Patent #9,424,665: Matthew Frazier; Biniyam Taddese; Steven Mark Anlage

### **“System and method for signals transmission in complex scattering environments using interaction of the waves with a nonlinear object”**

We invented a method to carry out exclusive communications with an object at an unknown location inside a complex scattering environment. This can also be used to send wireless power to multiple objects (such as cell phones or laptop computers) in a similar environment, like a coffee shop.

5. US Patent #8,624,605: Sameer Hemmady; Steven Mark Anlage

**“Apparatus and method to distinguish nominally identical objects through wave fingerprints”**

We invented a method to distinguish objects by means of their complex scattering properties. Each object (such as a computer or shipping container) will have a unique signature based on our invention, and changes to this signature will allow us to detect tampering with the object. This was the runner-up for the title “Invention of the Year 2008” at the University of Maryland.

4. US Patent #6,809,533: Steven Mark Anlage; David E. Steinhauer; Constantine P. Vlahacos; Frederick C. Wellstood

**“Quantitative imaging of dielectric permittivity and tunability”**

We have invented a scanning near-field microwave microscope that can make quantitative high-resolution images of the linear and nonlinear dielectric function. This can be used, for example, to assist in production of dielectrics for use in next-generation integrated circuits.

3. US Patent #6,376,836

Steven Mark Anlage; Bokke Johannes Feenstra; David Ethan Steinhauer;

**“Disentangling sample topography and physical properties in scanning near-field microwave microscopy”**

We have invented a scanning near-field microwave microscope that can uniquely separate the effects of sample bumpiness from variations in its electrical properties. This makes the microscope more reliable and useful than many competitors based on atomic force microscopy, for example.

2. US Patent #6,366,096

Vladimir V. Talanov; Steven Mark Anlage

**“Apparatus and method for measuring of absolute values of penetration depth and surface resistance of metals and superconductors”**

We invented a reliable way to measure the electrodynamic properties of superconductors, something which is very difficult to accomplish by other means.

1. US Patent #5,900,618

Steven Mark Anlage; Frederick Charles Wellstood; Kosta Vlahacos; David E.Steinbauer

**“Near-field scanning microwave microscope having a transmission line with an open end”**

We have invented a scanning near-field microwave microscope that can create images of the electrical properties of metals and dielectrics on length scales far smaller than the wavelength. The microscope can also image microwave fields from active circuits.

[Popular Summary of the Near Field Microwave Microscope](#)