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Anneli Waara/UU *24 September 2007*

Groundbreaking methods create an entirely new radio landscape

An group of international scientists, led from Uppsala, Sweden, show in an article in the latest issue of Physical Review Letters how methods, developed in laser optics and quantum communication, can be utilised in radio astronomy and space physics. The results open an entirely new radio landscape for, among other things, wireless communications.

The study shows how new methods, developed in laser optics and quantum communications, can be taken over directly into the radio domain. With a number of small antennas, each equipped with a digital radio unit, the scientists show for the first time than one can make use of well-known but underutilised symmetry principles of the electromagnetic fields that make up the radio signals. This enables the extraction of considerably more information from the radiation than possible with conventional methods. Internationally, these methods have attracted a large interest.

The electric and magnetic fields of a radio beam vary both in magnitude and in direction. The use of the information about the instantaneous direction of the fields has opened this entirely new and more efficient way of utilising the radio medium. An interesting property of the new methods is that the for a given radio path the same frequency can be used over and over again without the different radio signals interfering with each other, Fundamental concepts such as frequency bandwidth is thereby turned on their heads. Instead, the screw motion in space of a radio beam becomes important and all of a sudden a new radio landscape, completely different from the one we are used to, has emerged.

- One can imagine that in the future there will be an extra button on the radio set for tuning in another station. But instead of changing frequency, i.e., the way the radio signals vary in time, one also changes the way they rotate in space, says Bo Thidé who has led the study.

The radio methods that are described in the article have been developed within the sensor project LOIS in Växjo (www.lois-space.net) which cooperates with the giant radio telescope LOFAR (Low Frequency Array) in the Netherlands, Germany and France (www.lofar.org). In a recently constructed antenna chamber at the Ångström Laboratory in Uppsala the new radio methods are now about to be tested and assessed technically under well-controlled laboratory conditions.

The article has its origin in an undergraduate diploma work performed within the LOIS project by two students at the Uppsala School of Engineering.

- It is unique that students already during their undergraduate studies produce scientific results of such a calibre that they end up on the cover of the world's most prestigious physics journal, says Bo Thidé.

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Behind the study stand space physicists in Uppsala, Sweden, theoretical physicists in Moscow, Russia, and Oldenburg, Germany, astrophysicists in Glasgow, Scotland, and mathematicians in Karlskrona, Sweden.

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