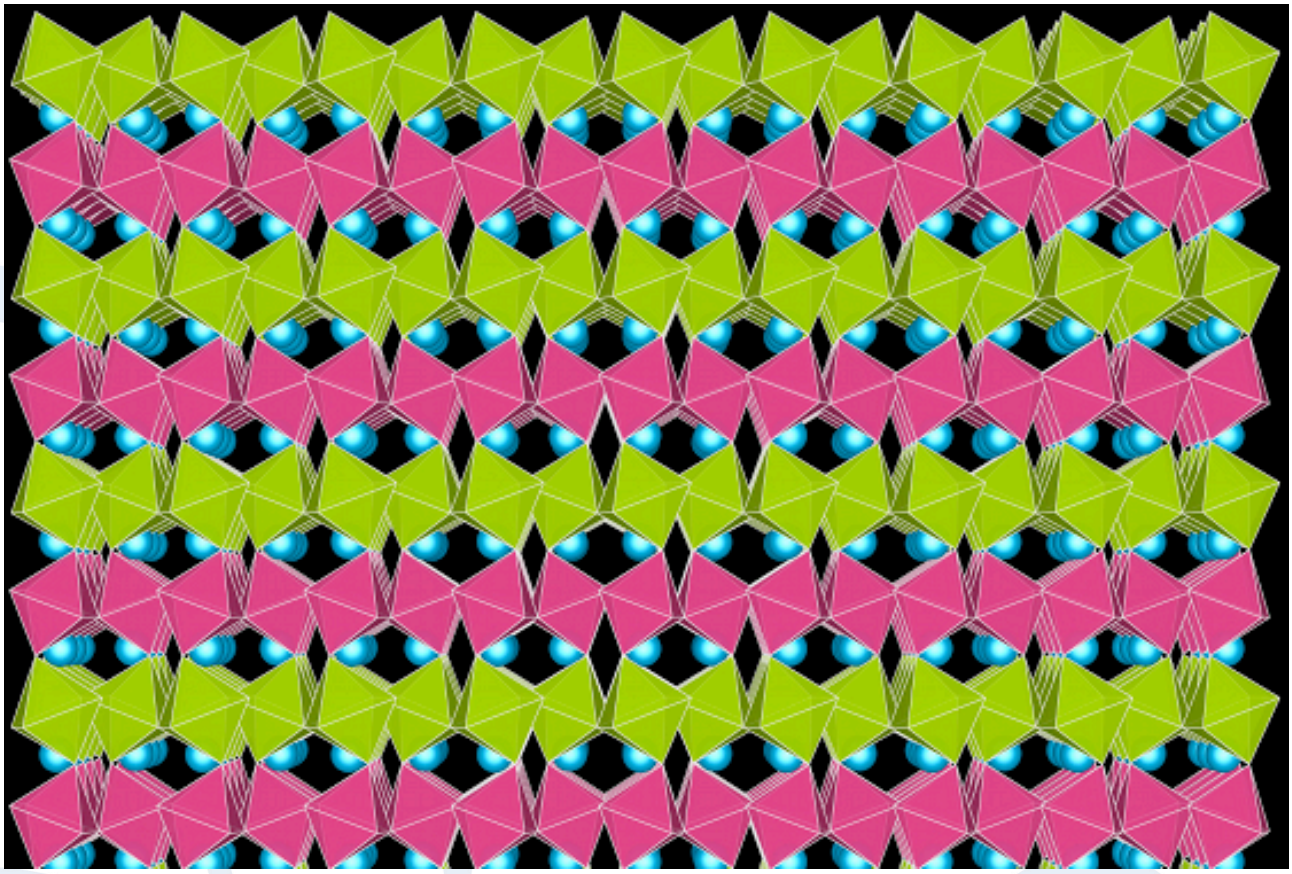
The Multiferroic Sandwich



Magnetic and Ferroelectric metal: the two faces of tomorrow's materials

September 4, 2015

Two properties are particularly sought after in materials for technology (for a variety of devices from sensors to computer memory, etc.): magnetism and ferroelectricity. Obtaining materials with both qualities is highly desirable. At the present time, these properties have shown to be almost entirely mutually exclusive, but a new study conducted by SISSA/Northwestern University introduces an innovative method which may soon become reality.

Magnetism and ferroelectricity: two properties which are particularly important for technology. The former is well known in empirical uses: it makes the needle of the compass point towards the North Pole, a magnetic field can align magnetic moments called spin of the electrons that make

up the material. The latter is the electric form of magnetism. Ferroelectric materials maintain electric polarization even after the electrical field that caused it is removed. The two properties are extremely useful, and would be even more so if they coexisted in the same material. At the moment one precludes the other: a material is either ferroelectric or magnetic.

Things may soon change. A new study conducted by SISSA and Northwestern University (Illinois, USA) published in the review Physical Review Letters, proposes a completely new model for creating these "multiferroic" materials.

"Ours is certainly not the first attempt at obtaining a material of this kind, but up to this point there has been little in terms of satisfying results," notes Massimo Capone, SISSA researcher and one of the authors of the study. "Our method is based on a surprising system." Capone and his colleagues' work is a theoretical study which will serve as a guide for developing the material itself.

"Our approach is based on creating a sort of sandwich with layers of Lithium Osmate, a ferroelectric metallic material, alternating with insulating material. Adding insulation causes magnetic properties to emerge from two non-magnetic materials. This arrangement, which we refer to in jargon as heterostructures, slows down electrons in the system, and it is this phenomenon that leads to the emergence of magnetism," explains Gianluca Giovanetti, SISSA/CNR IOM researcher, and one of the authors of the study.

"Our theoretical model shows a clear effect, and furthermore, we show that it is possible to control ferroelectricity with magnetism, another important property," concludes Capone. "The next step will be to test the material itself."

USEFUL LINKS:

- **Original paper on Physical Review Letters: http://goo.gl/vS1NYW**

IMAGE:

- **Credits: James Rondinelli**

Contatti:

Ufficio stampa:
pressoffice@sissa.it
Tel: (+39) 040 3787644 | (+39) 366-3677586

via Bonomea, 265
34136 Trieste

Maggiori informazioni sulla SISSA: www.sissa.it