

Negative capacitance detected

February 4 2015

Prof. Gustau Catalan has published in *Nature Materials* a commentary on the measurement of negative capacitance presented by the teams led by Prof Sayeef Salahuddin and Prof. Ramesh in the same magazine. The study detects negative capacitance in ferroelectrics, a field in which ICN2 researchers have significant expertise.

The researchers have published in [Nature Materials](#) an article about the detection of negative capacitance and its uses. The article's starting point is the research led by Prof Sayeef Salahuddin, from University of Berkeley, in which a technique to measure the phenomenon is proposed for the first time ([Nature Materials](#)).

Ferroelectricity is one of the main research lines of Prof Catalan's Oxide Nanoelectronics Group. In the article, the three authors summarize the concept of negative capacitance and detail how Prof Salahuddin's Group have detected it. Negative capacitance in [ferroelectric materials](#) has hitherto only been predicted theoretically.

Ferroelectrics switch their polarization when a certain critical [voltage](#) is reached. This causes an enormous, sudden accumulation of bound charge at the material's surface that can momentarily exceed the free charge supplied to the electrodes by a power source. If a resistance is placed between the electrodes and the charge supplied by the external voltage is slowed down, a decrease in voltage across the ferroelectric can be detected while the charge is still increasing. Consequently, the [capacitance](#) (charge divided by voltage) has a negative value.

Catalan, Jimenez and Gruverman discuss the advantages that its use suggests for designing new electronic devices, and specifically ultra-efficient transistors. However, due to the existence of many subtle problems that emerge when ferroelectrics are put in contact with semiconductors, the researchers also emphasize that there is still a great distance from the (important) proof of concept and the actual implementation in practical devices.

Provided by Catalan Institute of Nanoscience and Nanotechnology

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