Materials Department
University of California, Santa Barbara
*Colloquium*

# In Search of Electrostatic Happiness

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The bound charge at the surface of ferroelectrics, which must be screened to avoid a divergence in the electrostatic energy, is usually a nuisance in the development of electronic devices based on thin-film ferroelectrics. To surface scientists, on the other hand, bound surface charge is desirable because its reactivity can drive catalytic activity. In this talk, I will review the concept of surface charge in ionic insulators, both in the context of the polarization in ferroelectric materials and in the context of layers of charged ions traditionally discussed in the surface science community.

Using the prototypical multiferroic bismuth ferrite, $BiFeO_3$, as an example, I'll show how the spontaneous ferroelectric polarization and the charged ionic layers can in fact combine to yield stable, uncharged “happy” surface geometries. Switching the polarization causes these surfaces considerable electrostatic distress, which must be compensated by the introduction of charged point defects or adsorbates. We’ll see that the relative happiness or unhappiness of the surfaces both influences the ferroelectric hysteresis and enables a cycle of alternating charged then neutral adsorbates on polarization switching, which can be exploited for water remediation or splitting.

Finally, I'll introduce an analogous framework for magnetic surfaces, which can explain magnetization at the surfaces of compensated antiferromagnets and magnetic exchange bias.

Nicola Spaldin received her BA in Natural Sciences from Cambridge University and her PhD in Chemistry from University of California at Berkeley. After postdoctoral work in Applied Physics at Yale University, she joined the Materials Department at UC Santa Barbara (1997–2010) before taking on her current position as Professor of Materials Theory at ETH Zurich. She is Fellow of the Royal Society, Foreign Member of the US National Academy of Engineering and has received the Swiss Science Prize of the Marcel Benoist foundation, the Koerber European Science Prize, the L’Oreal-UNESCO Science Prize, and the American Physical Society McGroddy Prize for New Materials.

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