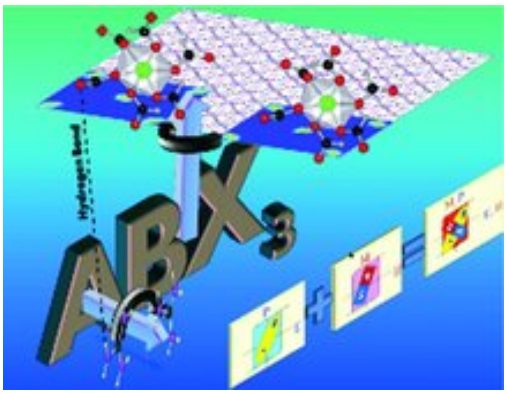
***Microscopic origins of ferroelectricity in Hybrid Organic-Inorganic Perovskites.***




Hybrid Organic-Inorganic Perovskites (HOIPs) are introducing new directions in the materials science landscape. In this talk, we will discuss the intriguing origin of ferroelectricity in HOIPs. In particular, we highlight the hybrid improper mechanism where Jahn-Teller cooperative distortions are subtly coupled to inversion symmetry breaking giving rise to a switchable electric polarization. Symmetry invariants theory permits to predict a magneto-electric coupling which has been recently confirmed by experiments.We propose further examples of the complex multifunctional behaviour arising from the organic and inorganic dual nature as well as from the interplay between ferroelectricity and spin-related properties in hybrid perovskites, by discussing a complex and recently synthesized ferroelectric layered two-dimensional HOIP, $(AMP)PbI_4$ (AMP=4-aminomethyl-piperidinium). We report a new effect, *i.e.,* an extraordinarily large Rashba anisotropy that is tunable by ferroelectric polarization: as polarization is reversed, not only the spin texture is inverted, but also the major and minor axes of the Rashba anisotropy ellipse in **k**-space are interchanged, *i.e.* a pseudo-rotation. A **k·p** model Hamiltonian and symmetry-mode analysis reveal a quadrilinear coupling between the cation-rotation modes responsible for the Rashba ellipse pseudo-rotations, the framework rotation, and the polarization.

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**Short bio**

A.S. graduated in Physics at University of L'Aquila (Italy) in 2002. He obtained PhD in computational materials science at University of Trieste (Italy) in 2006. He has been Post-Doc at University of Vienna (Austria) from from 2006 to 2008 under the supervision of Prof. G. Kresse. From 2008 to 2011 he has been research fellow under the supervision of dr. S. Picozzi at National Research Council (CNR) in Italy. He is now Research Director at CNR and Deputy Director of the SPIN Unit in L'Aquila.

His main expertise is density functional theory calculations of electronic, magnetic and structural properties of multifunctional materials, ranging from organic to inorganic and hybrid materials covering ferroelectrics, multiferroics, antiferromagnets.

Email: alessandro.stroppa@spin.cnr.it