MARVEL

THEOS
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ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

Are Polarization and Magnetization really bulk properties?

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Abstract: Textbooks typically attempt microscopic definitions in terms of the dipole moment per cell: this is only correct for the spin contribution to magnetization **M**, but is incorrect for both polarization **P** and for the orbital contribution to **M**. The microscopic quantities well defined inside a polarized material are the microscopic charge and current densities: these trivially determine the dipole (electric and magnetic) of a finite sample, but the sample boundary yields an extensive contribution to such dipoles.
Contrary to what textbooks pretend, the microscopic charge and current densities in the bulk of a sample do not determine the values of **P** and **M**. The problem has been solved in 1993 for **P** and in 2005-6 for **M**. In the latter case, there have been recent developments at the fundamental level [1]. In this talk I will outline the state of the art about **P** and **M**.

[1] R. Bianco and R. Resta, “Orbital Magnetization as a Local Property”, Phys. Rev. Lett. 110, 087202 (2013).