Abstract Submitted
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Flexoelectricity as a bulk property RAFFAELE RESTA, Università di Trieste, Italy — Piezoelectric composites can be created using nonpiezoelectric materials, by exploiting flexoelectricity. This is by definition the linear response of polarization to strain gradient, and is symmetry-allowed even in elemental crystals. However, the basic issue whether flexoelectricity is a bulk or a surface material property is open. We mention that the analogous issue about piezoelectricity is nontrivial either.[1] In this first attempt towards a full theory of flexoelectricity we prove that, for a simple class of strain and strain gradients, flexoelectricity is indeed a bulk effect. The key ingredients of the present theory are the long-range perturbations linearly induced by a unit displacement of a single nucleus in an otherwise perfect crystal: to leading order these are dipolar, quadrupolar, and octupolar. The corresponding tensors have rank 2, 3, and 4, respectively. Whereas dipoles and quadrupoles provide the piezoelectric response,[1] we show that dipoles and octupoles provide the flexoelectric response in nonpiezoelectric crystals. We conjecture that the full dipole and octupole tensors provide the flexoelectric response to the most general form of strain gradient. Our problem has a close relationship to the one of the "absolute" deformation potentials, which is based on a similar kind of dipolar and octupolar tensors.[2]

[1] R. M. Martin, Phys. Rev. B **5**, 1607 (1972).
[2] R. Resta, L. Colombo and S. Baroni, Phys. Rev. B **41**, 12538 (1990).

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