FLEXOELECTRICITY IN POLAR MATERIALS

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Flexoelectricity is a linear coupling between polarization and strain gradients that is allowed in any material. Naturally, it is most tempting to exploit such "universality" in order to elicit polarization out of non-polar materials. However, the best flexoelectric materials tend to be ferroelectrics, and moreover even formally non-polar materials such as $SrTiO_3$, or relaxors, or ferroelectrics in the paraelectric phase can nevertheless display built-in polarity in their behaviour [1]. It is therefore essential that we understand the interplay between flexoelectric polarization and pre-existing polarization.

In this talk I would like to discuss several ideas and results concerning the two-way interaction between flexoelectricity and ferroelectricity. We already know that flexoelectricity can be used to modify ferroelectricity (e.g., strain gradient engineering or flexoelectric switching [2]) and, conversely, that pre-existing polarization affects apparent flexoelectricity (e.g. apparently "giant" flexoelectricity [3]). Less is known, and this is something that I will discuss, about the effect of existing or induced polarization on converse flexoelectricity. Yet a third aspect that I will also cover is how the interaction between flexoelectricity and piezoelectricity affects, and is affected by, other material properties such as toughness and conductivity [4].

1. A. Biancoli et al, Nature Materials doi:10.1038/nmat4139 (2014).
2. Catalan et al, Nature Materials 10, 963–967 (2011); Lu et al, Science 336, 59–61 (2012).
3. Narvaez&Catalan, Appl. Phys. Lett. 104, 162903 (2014).
4. Abdollahi, Catalan, Arias (unpublished); Narvaez&Catalan (unpublished).