

Model for ultrafast polarization switching in PbTiO_3

Zhilyaev P A^{1,®}, Brekhov K A², Starykh E¹,
Akhatov I Sh¹ and Mishina E D²

¹ Skolkovo Institute of Science and Technology, Skolkovo Innovation Center
Bldg 3, Moscow 143026, Russia

² MIREA—Russian Technological University, Prospekt Vernadskogo 78,
Moscow 119454, Russia

® p.zhilyaev@skoltech.ru

Ultrafast switching of polarization in ferroelectric materials is a topical and promising direction of research [1]. Realization of this phenomenon can potentially lead to the development of new generation non-volatile energy efficient memory devices. In this work, we rely on the combined approach suggested in works [2]. This technique allows investigating the influence of the following parameters on the ultrafast dipole reversal: the high-frequency phonon mode choice, the type of the material, duration of the pulse, and the total number of pulses. We consider ferroelectric perovskite-like materials PbTiO_3 , widely used for memory and modulation devices. All possible high-frequency phonon modes, coupled with low-frequency dswitching by two sequential pulses is studied. Based on the obtained data, recommendations on the most effective switching scenario are given.

- [1] Kimel A, Kalashnikova A, Pogrebna A and Zvezdin A 2020 *Physics Reports* **852** 1–46
[2] Subedi A 2015 *Physical Review B* **92** 214303