Oxide-based Optoelectronics

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Integrated Si photonics has the potential to revolutionize information processing between the chips of integrated circuits as well as on a chip itself. Performing at least a part of the task with photons rather than electrons, creates new opportunities for broad band low power communication and computing. Here I will discuss the theoretical description of the linear electro-optic (EO), or Pockels, effect and a recently elucidated design rule for materials searches, and we discuss possible applications of Si-integrated optical elements based on perovskite oxides and their heterostructures. In particular, I will describe the Pockels effect in $BaTiO_3$ films grown on Si and intersubband transitions in Si-integrated perovskite quantum wells (QWs).