Title:	Effect of light electrostatic on the transport properties of oxide interfaces
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Abstract:	Perovskite oxides, especially their interfaces and superlattices have drawn renewed attention after the discovery of two-dimensional electron gas at the interface of two insulating perovskite oxides namely LaAlO3 (LAO) and SrTiO3 (STO). These interfaces are one of the promising candidates of 'Oxide Electronics'. These conducting interfaces show fascinating physical properties such as superconductivity, quantum oscillations in the conductivity, the appearance of strong spin-orbit coupling, multiferroicity, magnetism, electric field effect, photoconductivity, etc. Further, tuning of its conductivity using external stimuli is of interest not only because of its technological applications but also because of emergent physical properties that are interesting in the field of fundamental science. Among various external stimuli, the charge carrier density of these systems is tuned by light illumination and electrostatic gating mainly. Tuning their electrical properties upon light illumination has opened pathways for optoelectronic devices such as optical switches, holographic memory, etc. Besides STO-based heterostructures,for the last some years KTaO3 (KTO) based interfaces have also gained tremendous interest since it has demonstrated the possibility of hosting 2DEG with high electron mobility and strong spin-orbit coupling (SOC). The SOC in KTO is approximately one order of magnitude larger than STO, which projects KTO as a promising candidate for spintronic applications. The effect of light on the electrical conductivity of the KTO interface with other oxides is not well explored. In the first part of the thesis, we have explored the effect of light on insulating (3u.c.) as well as conducting (5u.c.) interface of LaVO3(LVO)/ STOusing light illumination having wavelength 405 nm and 532 nm at different values of temperature. under light illumination, an insulator to metal transition is observed for an insulating interface. Under 405 nm illumination, persistent photocurrent is observed at all temperature values but under 532nm light illumination PPC is observed only above 220K for conducting interface. We have proposed a relevant band diagram, to understand these findings. We have also explored the effect of light illumination on two recently reported KTO based conducting interfaces i.e. EuO/ KTO and LVO/ KTO. Here, LVO/ KTO interface is between two perovskite oxides but EuO/ KTO interface is between a non-perovskite−perovskite oxide. Both the samples have shown considerable response to light illumination and also similar photodynamics which signifies it is mainly governed by KTO. The EuO/ KTO has slightly higher PC and PPC than LVO/ KTO. Time-dependent resistance follows double exponential behavior for both samples. The time constant related to the fast component is independent but for the slow component, it decreases with an increase in wavelength of light illumination. Also, using the Laplace transform method we have calculated hole trap concentrations for both samples. Further, we have also checked the tuning of the conductivity under the electrostatic gate voltage and combined the application of light illumination and gate for the LVO/ KTO sample. A significant enhancement in resistance is observed under the joint effect of light illumination and negative gate voltage. This enhancement is found to show dependence on the magnitude of gate voltage. Further, we have also demonstrated a protocol to use this LVO/ KTO interface as a switch by applying light and gate voltage in particular manner.
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