Pulsed laser deposition of artificial layered oxides

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Complex oxides have attracted great interest since they exhibit a rich spectrum of physical properties such as ferromagnetism, antiferromagnetism, colossal magnetoresistance, ferroelectricity, dielectricity, and superconductivity. Novel heteroepitaxial devices based on these complex oxides, like spin-polarized ferromagnetic tunnel junctions, superconducting devices and piezoelectric devices, have great potential and are currently under investigation in many groups.
The nature of the above-mentioned physical properties in complex oxides is determined by very small characteristic length scales, comparable to the unit cell lattice parameters of complex oxide. Because of these small characteristic length scales, growth control on an atomic level is essential in epitaxial heterostructures. Furthermore, the terminating atomic layer of each complex oxide thin film in these structures influences the interface properties and, consequently, the device performance. Interfaces therefore play an important role in the physical and electrical properties of the complex oxide devices and growth control on an atomic level is essential.
Recently, a new “degree of freedom” has been recognised. By atomic control of interfaces between oxide materials, i.e., the chemical composition and crystalline structure, new phenomena can be observed. One example is the electronically conducting interface between $SrTiO_3$ and $LaAlO_3$, both insulating oxides.
In this presentation I will address the recent developments as well as future challenges of oxide thin film growth by Pulsed Laser Deposition