The presented project focuses on the investigation of an old, yet understudied ferroelectric material, Gadolinium Molybdate (GMO). GMO is a fully ferroelastic and fully ferroelectric material being part of the so called -Multiferroic materials-. Multiferroics are materials in which more than one ferroic order coexists in the same crystalline phase. In the last 10 years much attention has been driven on the stabilization of thin films of multiferroic materials, mainly focusing on materials who exhibit ferroelectric and ferromagnetic ordering. One of the main goals of this field is the assessment of the functional properties of these novel materials in thin films, since many unexpected properties and effects are observed at the nanoscale. Another reason for this interest is the importance of understanding the dimensional limits in which functional properties of multiferroics can be applicable in electronics.

As mentioned before, GMO is a fully ferroelectric and full ferroelastic material, which, to the benefit of this project, has never been studied in thin films. Therefore, its dielectric, morphological and crystalline properties are unknown at the nanometric scale, and moreover, its possible integration in magnetostrictive superstructures is still unclear. The potential application of GMO comes from its ferroelasticity, which can promote structural changes on soft magnetic materials (upper layers), allowing the magnetic writing of information, due to strain, by electric means.

This project focuses primarily on the epitaxial stabilization of high quality GMO thin films on few of the most commonly used substrates Si, $SrTiO_3$ and YSZ by Pulsed Laser Deposition (PLD). A systematic approach is proposed in order to investigate the optimal deposition conditions of the GMO thin films for each substrate, followed by a thorough characterizations of their crystallographic (XRD, HR-TEM) , morphological (AFM), chemical (XPS) and functional (PFM, SQUID) properties. The proposed methodology is designed to answer fundamental questions such as: What is the influence of film thickness on ferroelectric/ferroelastic response of GMO? And What is the epitaxial strain influence on the morphological and functional properties of GMO films?,

Finally, it is important to remark that preliminary studies, presented in the description of this project, show its feasibility and validate the methodology proposed. Our project deals with an interesting material that is rarely taken into consideration, so still much fundamental research is needed in this area.