Publ. Astron. Obs. Belgrade No. 103 (2024), 72 *Topical Invited Lecture*
https://doi.org/10.69646/aob103p072

INTEGRATING PULSE LASER DEPOSITION AND ADVANCED SPECTROSCOPY: UNVEILING HIDDEN PHENOMENA IN TRANSITION METAL OXIDES

MILAN RADOVIĆ

Paul Scherrer Institut
E-mail milan.radovic@psi.ch

Abstract. Transition Metal Oxides (TMOs) exhibit unique, multifunctional phenomena due to the interplay between spin and orbital degrees of freedom and the lattice. Controlling the electronic structure of TMO thin layers is essential for designing heterostructures where new phases and phenomena emerge. Combining Pulse Laser Deposition (PLD) with advanced spectroscopy techniques like Angle-Resolved Photoemission Spectroscopy (ARPES) and Resonant Inelastic X-ray Scattering (RIXS) has been pivotal for understanding and manipulating TMOs. This synergy enhances fundamental insights and optimizes material properties for specific functionalities.

Two examples will illustrate the power of this experimental platform. Firstly, controlling the Metal-Insulator Transition (MIT) via dimensionality crossover will be presented. A RIXS study on CaVO3 demonstrated that MIT is influenced by electronic bandwidth and the local site environment, showcasing precise manipulation of TMO electronic properties.

Secondly, the induced ferromagnetic order in thin NdNiO3 (NNO) films, in proximity to a magnetic layer, will be discussed. This study shows how magnetic interactions can be harnessed to influence TMO electronic behavior.

Both examples highlight functional approaches to manipulating TMO electronic and magnetic properties.

References

McNally E. D., Lu X., Pelliciari J., Beck S, Dantz M., Naamneh M., Shang T., Medarde M.,.Schneider W. Ch,,. Strocov N. V., Pomjakushina V. E., Ederer C., Radovic M., Schmitt T., 2019, *npj Quantum Materials* **4:6**.

Caputo M., Ristic, Z., Dhaka S. R., Das T., Wang Z., Matt E. C., Plumb C. N., Guedes B. E., Jandke J., Naamneh M., Zakharova A., Medarde M., Shi M., Patthey L., Mesot J, Piamonteze C, Radovic M, 2021 *Advanced Science* **8**, 2101516.