Paul Scherrer Institut

Wir schaffen Wissen – heute für morgen

Advisory Board Meeting PSI Fellowship

14th November 2013, Villigen PSI

Valentina Bisogni - PSI Fellow at ADRESS BL, SLS

Supervisor: Dr. Thorsten Schmitt

Personal Background

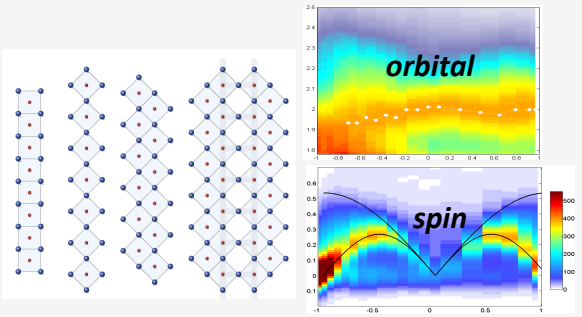
SLS, PSI in Villigen

PSI Fellow co-funded FP7

2010-2012: IFW Dresden
Post Doc – DAAD Fellow

Topic: Spin, charge, orbital dynamics in low dimensional cuprates

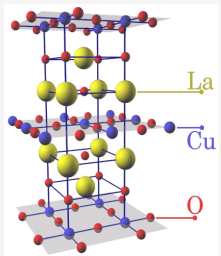
Supervisor: Dr. J.Geck

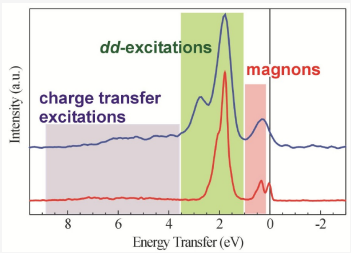


2007-2010: ESRF in Grenoble
PhD in Physics (Politecnico di Milano)

Thesis: Local and collective excitations in cuprates investigated by high-resolution resonant inelastic x-ray scattering

Supervisor: Prof. L. Braicovich
Dr. N. B. Brookes

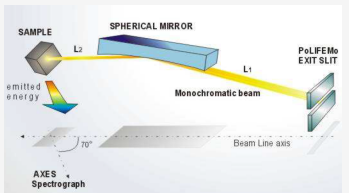


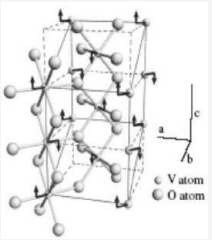


2001-2006: Politecnico di Milano
Graduated in **Physics Engineering**

Thesis: Soft x-ray resonant scattering: contributions to the instrumentation and to VO_2 Spectroscopy.

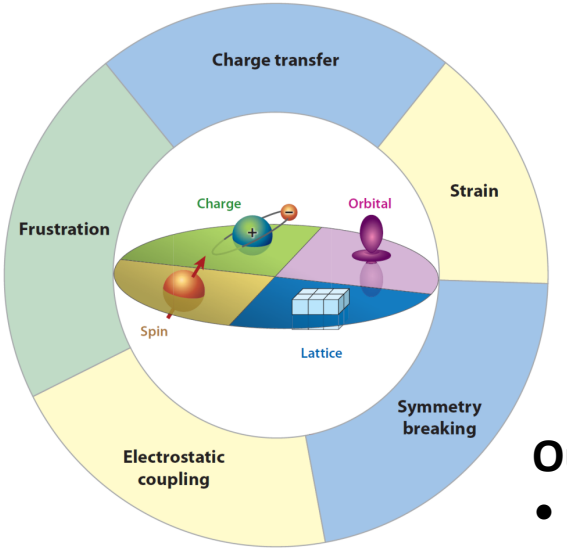
Supervisor: Prof. L. Braicovich





Scientific Background of PSI-Fellow Project

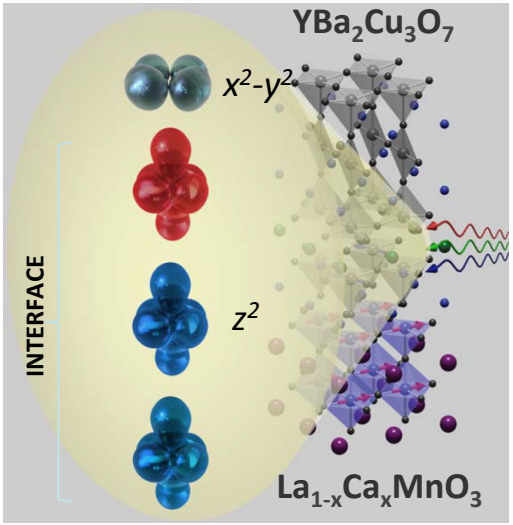
- **Resonant Inelastic X-ray Scattering on Heterostructures of trasition metal oxides**



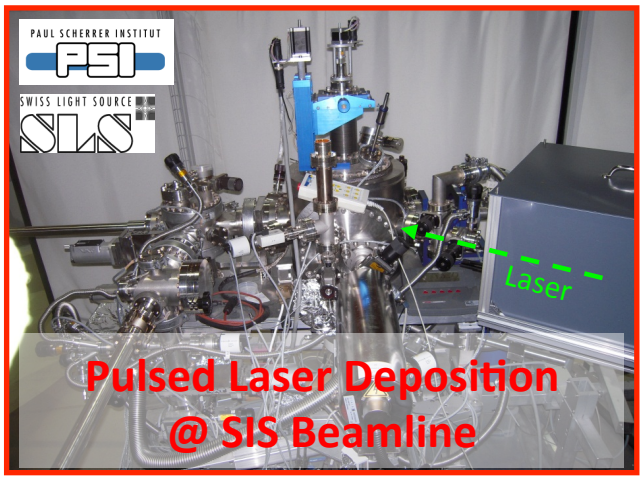
- Transition metal oxide (**TMO**): strong interaction of **charge**, **orbital**, **spin** and **lattice**
- **Interface** between TMOs: **novel properties** respect to the bulk, triggered by local effects (strain, frustration, coordination…)
- Opportunity for **engineering new properties**

Our Project:

- oxides films/heterostructure with atomic control at interface: **PLD**
- bulk, site and chemically sensitive X-ray probes: **XAS** and **RIXS**



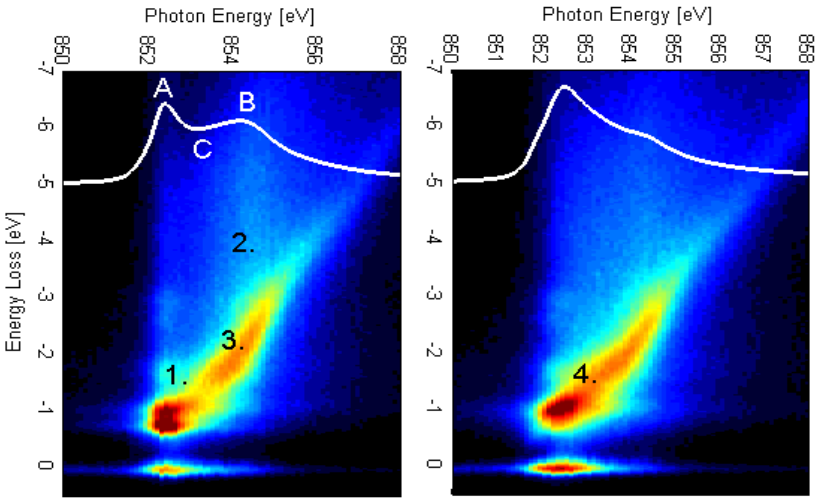
Chakhalian et al., Science 318, 114 (2007)

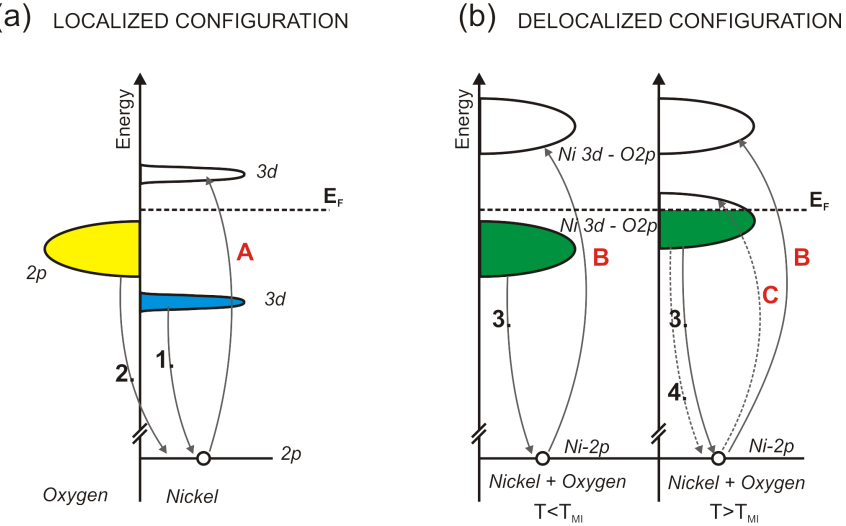


G. Ghiringhelli et al., Rev. Sci. Instrum. 77, 113108 (2006)

First results of my work

- **Understanding ground state in Metal-Insulator Nickelate films, $RNiO_3$** (R=rare earth)

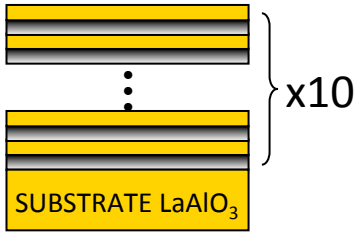


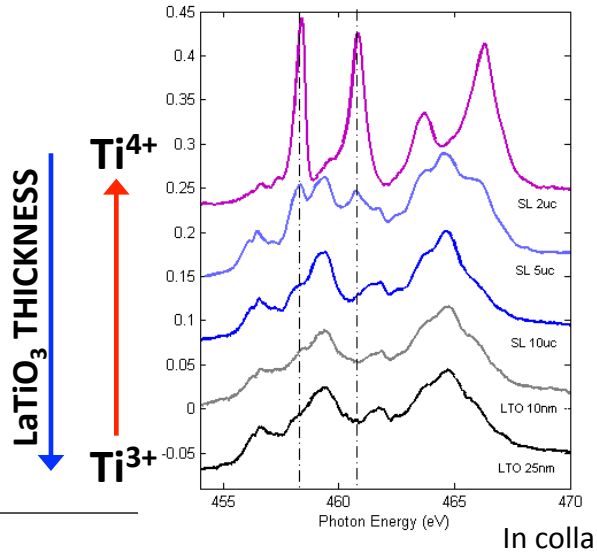


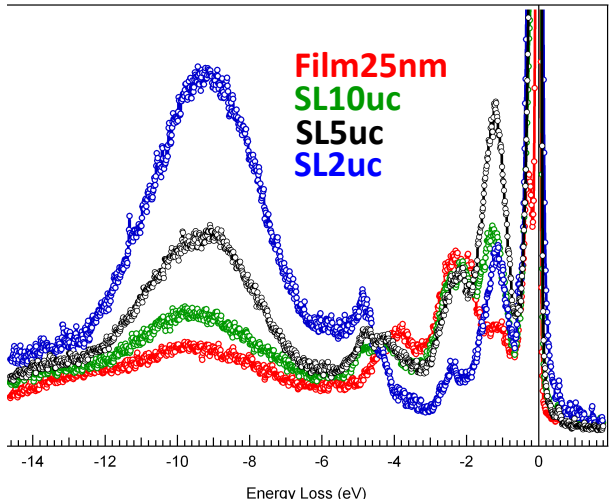
In collaboration with Prof. J.M. Triscone group, University of Geneva

- **Tuning Ti valence state in $LaTiO_3/LaAlO_3$ heterostructures**
  - **$LaTiO_3$ film (25nm, 10nm)**

  - **$LaTiO_3$ superlattices (10uc,5uc,2uc)**







In collaboration with M. Radovic,N. Plumb, SIS BL, SLS-PSI

Publication & Conferences

Publications record:

- Two papers (collaboration between PSI-IFW Dresden) finalized and submitted to Physical Review Letters
- Two papers (one on Nickelate project, one on Titanates project) are currently under preparation

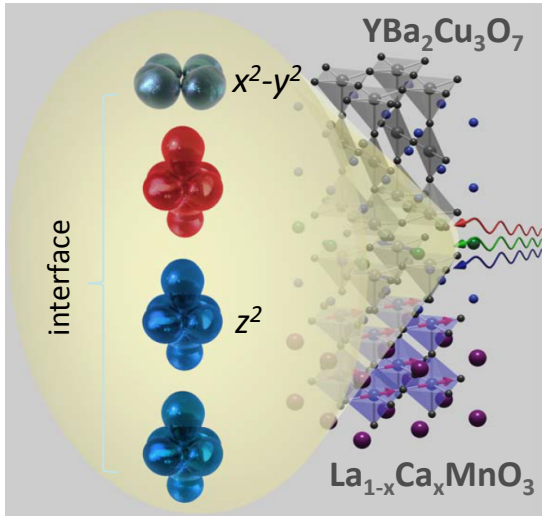
Conference contribution:

- Spectroscopy on Novel Material Workshop, Switzerland – 3/2013 (invited talk)
- Inelastic X-ray Scattering Conference, California – 8/2013 (invited talk)
- FisMat 2013 Conference, Italy – 9/2013 (regular talk)

Next steps within the project planning

- finalize the studies on Titanates project (investigation of oxygen role)
- finalize the writing of the first papers
- start new research project on cuprate/manganite heterostructures

Example of YBCO/LSMO



Chakhalian et al., Science 318, 114 (2007)

$(La_{1-x}Sr_xCuO_4)_n/(La_{1-x}Ca_xMnO_3)_m$ superlattices

- $La_{1-x}Sr_xCuO_4$: high temperature superconductor / insulator
- $La_{1-x}Ca_xMnO_3$: ferromagnetic / antiferromagnetic material

Our project:

- Orbital reconstruction
- Effects on the spin dynamics by coupling FM/AFM with SC at the interface

PROPOSAL ACCEPTED for BEAMTIME - I semester 2014

Critical paths & contingency plan

Critical path:

- sample quality
- delicate measurements because of the small sample volume involved
- new field – completely unexpected results
- interpretation of the data

Contingency plan:

- **samples:** modify growth parameters or switch to a different system (substrate, thickness, target). The in-house PLD facility to grow films is a big advantage to this project, ensuring flexibility if needed.
- **samples:** Collaboration with University of Geneva

Resources available versus resources needed

Resources available

- X-ray Absorption and Resonant Inelastic X-ray Scattering facilities are readily available from the ADRESS Beamline (world-leading for RIXS)

- Beamtime for the project granted through peer-reviewed proposals (3 ACCEPTED so far) and from the in-house time

- Samples:

1) LTO/LAO films/superlattices as well as Cuprate/Manganite superlattices provided in-house through collaboration with M. Radovic (SIS Beamline)

Resources needed

- Films/Superlattices characterization in terms of Resistivity, X-ray diffraction, AFM measurements: available within PSI, and through collaboration with Dr. M. Salluzzo, Universita'di Napoli
- Samples:

2) Ni-project films provided through collaboration with Prof. J.M. Triscone University of Geneva

- Theory: collaboration with Prof. G. Sawatzky, UBC Vancouver.

Outlook to future career

- **Beamline Scientist** position at **Brookhaven National Laboraty, SIX beamline** dedicated to high resolution/high efficiency RIXS (from February/March 2014 – Tenure-track program)

PSI-Fellow programme: expectations, pros and cons

Expectations:

- work in a high level international research team
- deepen scientific skills and competences by working with the world leading Resonant Inelastic X-ray Scattering spectrometer
- boost personal scientific profile by obtaining a prestigious Fellowship

Pros:

- being part of a European Program cofunded by Marie Curie Action and PSI
- PSI Fellowship educational program (Career-starting Workshop, how to write proposal for Horizon2020,…)
- opportunity to administrate a Mobility Allowance for extra-project activities
- opportunity to belong to the Marie Curie Alumni Network

Cons:

- no teaching experience possible at PSI

PAUL SCHERRER INSTITUT

Thanks for your attention