



Descrizione delle borse riferite a programmi specifici di ricerca e/o finanziate da soggetti esterni

- SCIENZE E BIOTECNOLOGIE AGRARIE

Project title and supervisor	Description/Reference
A1. Effect of abiotic stresses on phenotypic plasticity of grapevine varieties tolerant to fungal diseases (Supervisor Paolo Sivilotti)	Grapevine genotypes show different strategies to cope with water shortage during the growing season. Based on the mechanisms adopted, we can classify into anisohydric and isohydric varieties. In recent times, this division have been discussed since in particular conditions the varietal typical hydraulic behavior can change. There is still confusion on which condition could show the typical hydraulic behavior and which not. Thus, the research would like to study the physiological plasticity of grapevine varieties tolerant to fungal diseases to cope with different conditions of water stress.
A3. Resistance to PSA (<i>Pseudomonas syringae</i> pv. <i>actinidiae</i>) in actinidia ibrids (Supervisor Guido Cipriani)	For further information about the topic read the paper available at https://link.springer.com/content/pdf/10.1007%2Fs11295-015-0846-1.pdf
B2. Feeding strategies of dairy cows to reduce aflatoxin in milk (Supervisor Mauro Spanghero)	Further information of the project entitled "Feeding strategies of dairy cows to reduce aflatoxin in milk" are available at: https://sav.uniud.it/en/projects/afla1milk/
C1. Understanding multiple interaction among stress factor in the hive ecosystem (Supervisor Francesco Nazzi)	To get an idea about the subject as well as the approach and scope of the research activity which the PhD project is included in, please see the article: https://www.sciencedirect.com/science/article/pii/S1471492214001639?via%3Dihub
C3. Exploring the molecular mechanisms underlying the pathogenesis of phytoplasmas. (Supervisor Marta Martini)	Please refer to the web site of the research team in plant pathology (muffa.uniud.it) for further information on this research line.



- **INFORMATICA E SCIENZE MATEMATICHE E FISICHE**

An experiment to measure the most challenging transition in muonic hydrogen

One intriguing question of modern atomic physics is the discrepancy in the determination of the proton charge radius extracted from measurement of transition frequency in hydrogen atom and in muonic hydrogen. The discrepancy is the so called proton radius puzzle.

The FAMU (Fisica degli Atomi MUonici – physics of muonic atoms) experiment aims to determine the Zemach radius of the proton by measuring the hyperfine splitting in muonic hydrogen ground state. Up to know, the Zemach radius has been measured only in ordinary hydrogen. Hopefully, this measurement with muonic hydrogen will shed light on the proton radius puzzle.

Muonic hydrogen allows high precision spectroscopy studies of the fundamental interaction of the structure of the proton. FAMU proposes an innovative method to measure the hyperfine splitting.

Muonic hydrogen is formed by collision of a muon beam in a gas target containing a mixture of hydrogen and oxygen. A thermal muonic hydrogen atom in the para state (total spin $F=0$), after absorbing a photon having the resonance energy $\Delta E_{\text{hfs}} \approx 0.182$ eV is excited to the ortho ($F=1$) spin state. Very quickly then, in subsequent collisions with the surrounding H_2 molecules, muonic hydrogen de-excites to ($F=0$). Because of energy and momentum conservation, at the exit of the collision, the muonic hydrogen is accelerated by $\sim 2/3$ of the ΔE_{hfs} excitation energy which takes away as kinetic energy. The muon is transferred from μ^+p to μ^+O at a rate $\lambda_0(E)$ that considerably increases with the energy of the μ^+p . By varying the emission wavelength of a tunable laser, it is possible to experimentally observe the number of muonic atoms that have undergone the above sequence of processes and in this way to identify the resonance wavelength as the value for which the number of spin-excited atoms and hence of X-rays from transfer to oxygen is maximal. The observable is the time distribution of the characteristic X-ray of the muonic atoms formed by muon transfer from hydrogen to oxygen and its response to variations of the laser wavelength.

Currently, FAMU is reaching its most exciting phase. More preparatory experiments have been performed to test the feasibility of the method, at the RIKEN RAL muon accelerator facility in Oxford (UK) where the experiment takes place. The final setup is being finalized in its design, built and tested.

FAMU foresees the acquisition of the first physics run at the beginning of 2020.

The FAMU group in Udine & Trieste is very active: the Principal Investigator is located here, as well as the full analysis and simulation team. Moreover, the Udine & Trieste group is responsible for the laser development and construction. The laser is being assembled in dedicated laboratories at INFN Area di Ricerca and at Elettra Synchrotron.

Topic of studies are:

- Laser system: the development of a tunable and powerful laser system is one of the technological challenges of this experiment. The system is based on mixing single frequency single longitudinal mode Nd:YAG laser (1.064 μm) and a tunable, narrow bandwidth, Cr:forsterite laser (~ 1.262 μm) pumped by a second Nd:YAG synchronized to the first one. It is an attractive scheme due to its compactness, energy scalability and ability to fulfil the other required laser parameters like tunability and narrow line-width.
- Further improvement of the system for future runs.
 - o In particular one of the crucial points is perfecting the detection system by means of Silicon drift detectors SDD expressly developed within the collaboration.
 - o Simulation studies using GEANT4. A dedicated simulation has been developed for studies supporting the analysis or layout optimization of future runs.
 - o Data analysis: analysis is carried on in small teams that follow the whole procedure from signal reconstruction and calibration to final results.

Working in FAMU is an opportunity for an inclusive experience: it is an international collaboration (Italy, Bulgaria, Poland, Japan, India, and China) yet small enough to allow and encourage its members to work on a wide range of activities. From setting up the detectors before an acquisition run, to deeply understand the various aspects of the experiment, ranging from the hardware to the physics and to most theoretical points of view.



- **ALIMENTI E SALUTE UMANA**

Borsa Electrolux: <https://theresearchhub.electrolux.com/phd/>

- **INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE**

Borsa Electrolux: <https://theresearchhub.electrolux.com/phd/>

Nota: il presente documento potrà essere integrato in itinere.