WS4 MOSEM2 PROJECT. INTEGRATION OF DATA ACQUISITION, MODELLING, SIMULATION, AND ANIMATION FOR LEARNING ELECTROMAGNETIC AND SUPERCONDUCTIVITY

Ewa Kedzierska, *AMSTEL Institute, University of Amsterdam, Amsterdam, The Netherlands*
Libor Konicek, *University of Ostrava, Ostrava, Czech Republic*

The MOSEM2 project, funded by European Commission, seek to extend the experiments and materials from the twin project MOSEM by adding a set of computer aid activities covering a series of topics in electromagnetism and superconductivity. The new developed activities integrate different ICT technologies: data acquisition, data video, modelling, simulation and animation. The MOSEM2 primarily targets physics teachers in upper secondary schools and trainee physics teachers.
The first part will contain the presentations of three experiments, with the data acquisition, modelling, simulation, and animation.
Program of workshop:

- Introduction to MOSEM2 project & integration concepts - Vegard Engstrøm
- Explanation different ICT techniques - Ewa Kędzierska
- Explanation using of simulations - Francisco Esquembre
- Summary of pedagogical issues, future of project - Wim Peeters
- Three different experiments will be presented with different data acquisition methods:
  1. Explanation of experiment “Temperature depending of resistivity in bulb”
  2. Explanation of experiment “Oscillating magnet in coil”
  3. Explanation of experiment “Ski jumping in a magnetic field”
- Minds-on activities and Coach for participants (rotation)

The second part of workshop will be active work of all participants. They will make real experiments with data acquisition, modelling, simulation. Different types of worksheets are offered for educational proposal.
In the workshop the single experiments, methodological approach, the role of multimedia in learning path on superconductivity will be discussed.

WS4_T3_116 DATA ACQUISITION EXPERIMENTS AND MODELING ON TEMPERATURE DEPENDING OF RESISTIVITY IN BULB IN THE MOSEM2 PROJECT

Mario Gervasio, Marisa Michelini, Lorenzo Santi, *Department of Physics, University of Udine, Udine, Italy* (mario_gervasio@libero.it, michelini@fisica.uniud.it, santi@fisica.uniud.it)
Ewa Kędzierska, *AMSTEL Institute, University of Amsterdam, Amsterdam, The Netherlands* (e.kedzierska@uva.nl)
Libor Koníček, *University of Ostrava, Department of Physics Faculty of Science, Ostrava, Czech Republic* (libor.konicek@osu.cz)

High temperature resistivity measurements for metals are difficult to organize in the school lab. Some commercial devices, as a bicycle bulb, are produced to be able to operate by using the incandescent emission of a metal (tungsten – W) wire. The only problem is than to be able to obtain carefully measurements of electric characteristics as a function of the temperature of the metallic wire. Increasing electric power supplied to the wire, different regions of the filament behaviour are experimented. These regions are in connection with its internal energy and temperature. Computer aided experiments – data acquisition systems measured V and current I circulating in the wire of the bulb for a study of the electrical transport properties of metals in the range from 20℃ to 2600 ℃. With this simple device and experime nt, students make use of a technological device to individuate the phenomenological law of the electric transport properties of tungsten and to investigate the characteristics of the bulb and their role in different thermodynamic processes involved in the heating of the filament by means of the electric power. There are possible use different data acquisition systems for data logging. Some of these systems support measurement of bulb conductivity in non stationary conditions. It gives new possibility for inquiry for pupils.

WS4_T3_117 ON-LINE DATA ACQUISITION EXPERIMENTS AND MODELING ON ELECTROMAGNETIC INDUCTION WITH A COIL AND A MAGNET IN THE MOSEM2 PROJECT

Marisa Michelini, **Lorenzo Santi**, Alberto Stefanel, *University of Udine, Udine, Italy* (michelini@fisica.uniud.it, santi@fisica.uniud.it, stefanel@fisica.uniud.it)

Though electromagnetic phenomena are quite clear exploring simple experimental situations, as for instance a magnet inserted in a coil. Not so obvious is the recognition of the role of the magnetic field B flux and it time variation in the Faraday-Neuman-Lenz law that is the basic law describing this phenomenology. B field on-line sensors can give us the opportunity to bridge this gap. In the limit of the Leonardo da Vinci

Mosem^2 project we develop a chain of explorative proposals. These aim to discover electromagnetic induction having flux as conceptual organizer. The induced current in a coil is measured by a voltage/current sensor, when a magnet: is manually inserted in the coil, free fall down into the coil, is inserted in the coil with different controlled velocities, oscillate under the action of a spring. The recognition of asymmetries in the collected signals stimulate to explore B generated by the magnet, using a Hall probe and a flux-meter. The accurate results obtained give the opportunity to propose simple formalized models based on B flux changes in time that can give account of the phenomenology.

WS4_T3_118 VIDEO DATA ANALYSIS OF "SKI JUMPING" OF IRON BALL IN A MAGNETIC FIELD IN THE MOSEM2 PROJECT

Ewa Kędzierska, *Amstel Institute, University of Amsterdam, Amsterdam, The Netherlands* (e.kedzierska@uva.nl)
Libor Koníček, *University of Ostrava, Department of Physics Faculty of Science, Ostrava, Czech Republic* (libor.konicek@osu.cz)
Alberto Stefanel, *University of Udine, Udine, Italy* (stefanel@fisica.uniud.it)

The interaction between a magnet and an iron ball is a very hard challenge on the theoretical point of view. Even if we can only develop a phenomenological approach, our exploration should be guided by a rough model of the interaction.
The video analyses of real experiment give data for inquiry based learning of pupils. The pupils explore a real (relevant) situation analyzing them with empirical suggested but not supported by a theory. They can recognize the value to use model to understand natural phenomena, they recognize the range of validity of the model and also recognize when the model collapse.
They are involved in a situation that is usual in the modern physics where the occurred interaction is characterized analyzing only changes in the interacting systems quantities.