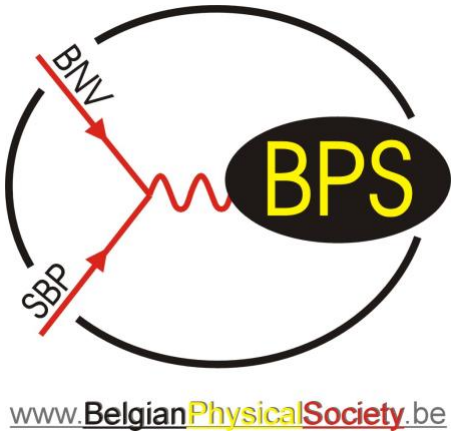
Belgian Physical Society

Belgische Natuurkundige Vereniging

Société Belge de Physique

General Scientific Meeting 2019

PROGRAMME SUMMARY



Université libre de Bruxelles – May 22nd, 2019
https://www.belgianphysicalsociety.be/event/conference-2019/index

PROGRAMME OVERVIEW

08:15 Registration and Welcome coffee (in front of Forum-F and G)

09:00 Invited Plenary Lectures (Forum-A)

09:00-9:10 Welcome by Jef Ongena, BPS President
09:10-10:00 Prof. **Hamid Aît Abderrahim** (SCK-CEN, Mol, Belgium) :
The MYRRHA project
10:00-10:50 Prof. **Vladimir Tikhonchuk** (Université de Bordeaux) :
Physics of matter under intense radiation fields under study at the ELI and Laser Megajoule laboratories

10:50-11:15 Coffee break

11:15 Young Speakers Contest (Forum-A)

11:15-11:25 Introduction of the European Physical Journal (EPJ)
11:25-11:45 **Marco Di Liberto** (ULB): Realization of Aharonov-Bohm Cages in Photonic Lattices
11:45-12:05 **Daniela Mockler** (ULB): Measurement of the cosmic ray spectrum with the Pierre Auger Observatory
12:05-12:25 **Johan Van der Tol** (KULeuven): Cluster gasses: when the equipartition theorem loses its validity

12:25 Conference picture

12:30 Walking lunch (restaurant) & poster session (in front of Forum-A)

14:30-18:10 Parallel sessions

Fundamental Interactions, Particle and Nuclear Physics (Forum-E)
Condensed Matter and Nanostructure Physics (Forum-A)
Bio-, Medical, Statistical & Mathematical Physics (Forum-G)
Atoms, Molecules, Optics, and Photonics (OF2072)
Astrophysics, Geophysics, and Plasma Physics (Forum-H)
Physics and Education (OF2070)

16:30-17:00 Coffee break

18:10-18:30 Closing ceremony (Forum-A)
Master Thesis, Best Poster & Young Speaker prizes

PARALLEL SESSIONS PROGRAMME

Fundamental Interactions, Particle and Nuclear Physics

Conveners: Barbara Clerbaux (ULB), Freya Blekman (VUB), Forum-E

14:30 – 15:10 Invited talk: **Gudrun Hiller** (University of Dortmund, Germany)
Flavor physics as a window to new physics

15:10 – 15:30 **Luca Mantani** (UCLouvain)
Top-quark electroweak interactions at high energy

15:30 – 15:50 **Vandecasteele Jérôme** (ULB)
Feebly Interacting Dark Matter through the Kinetic Mixing Portal

15:50 – 16:10 **Sam Junius** (VUB & ULB)
A feeble window on leptophilic dark matter

16:10 – 16:30 **Tom Cornelis** (UGent)
Search for heavy neutral leptons with the CMS detector

16:30 – 16:50 **Coffee break**

16:50 – 17:10 **Aleksandra Lelek** (UAntwerpen)
The Parton Branching method: new precision level in collider predictions

17:10 – 17:30 **Cintia Willemyns** (UMons)
Baryon spectrum in the large N c limit

17:30 – 17:50 **Iaroslav Meleshenkovskii** (SCK-CEN & ULB)
An artificially intelligent look on the uranium enrichment determination problem using X- and gamma-ray spectroscopy: introducing a new isotopic code CAMILA for CZT and LaBr3(Ce)

Condensed Matter and Nanostructure Physics

Convener: Simone Napolitano (ULB), Forum-A

14:30 – 15:10 Invited talk: **Mark Geoghegan** (University of Sheffield, UK)
How surface topography, properties, and nanostructure controls single polymer interfacial diffusion

15:10 – 15:30 **Shova Neupane** (UHasselt)
Controlling Localized Corrosion by Lateral Modification of Surfactant Inhibitors

15:30 – 15:50 **Kristof Moors** (KULeuven)
Supersonic flow and negative local resistance in hydrodynamic Dirac electron nozzles

15:50 – 16:10 **Andra Iordanescu** (UCLouvain)
Interferometric measurement of an electrically-biased tip perturbation

16:10 – 16:30 **Serghei Klimin** (UAntwerpen)
Collective excitations in one- and two-band condensed

16:30 – 16:50 **Coffee break**

16:50 – 17:10 **Piero Ferrari** (KULeuven)
The influence of palladium doping on the geometry and the stability of small cationic gold clusters

17:10 – 17:30 **Michael Sluydts** (UGent)
The road to accuracy: machine-learning-accelerated silicon ab initio simulations

Bio-, Medical, Statistical & Mathematical Physics

Convener: Patricia Losada Perez (ULB) & Thomas Gilbert (ULB), Forum-G

14:30 – 15:10 Invited talk: **Francesc Sagués** (Universidad de Barcelona, Spain)
The microtubule/kinesin system: A versatile realization of an active nematic

15:10 – 15:35 Invited talk: **Karel Proesmans** (UHasselt)
A perfect spring

15:35 – 16:00 Invited talk: **Hennie Valkenier** (ULB)
Synthetic Receptors for the Transmembrane Transport of Anions

16:00 – 16:20 **Francesca Cecchet** (UNamur)
Shedding light on nanoparticles/cell membranes membranes interactions with nonlinear optical spectroscopy

16:20 – 16:50 **Coffee break**

16:50 – 17:10 **Joseph Indekeu** (KULeuven)
Solving nonlinear differential equations by analytic iteration

17:10 – 17:30 **Derick Yongabi** (KULeuven)
Detection of cell-material interactions and beyond -A QCM-D study of yeast, bacteria and human cells

17:30 – 17:50 **Stefanos K. Nomidis** (KULeuven)
Twist-bend coupling: A twist in DNA mechanics

17:50 – 18:10 **Frederik Vreys** (UHasselt)
Towards lab-on-card, label-free enzyme immunoassays based on electrical impedance spectroscopy

Atoms, Molecules, Optics and Photonics

Convener: Xavier Urbain (UCL), Room OF2072

14:30 – 15:10 Invited talk: **Stephen Hogan** (University College London),
Matter-wave interferometry with highly excited atoms

15:10 – 15:30 **Senne Van Loon** (UAntwerpen)
Transition from supersonic to subsonic waves in superfluid Fermi gases

15:30 – 15:50 **Jérôme Deprince** (UMons)
X-ray emission from highly-ionized iron ions embedded in high-density astrophysical plasmas

15:50 – 16:10 **Arnaud Dochain** (UCLouvain)
Mutual Neutralization Studies of S/O anions and Na/Ne cations at Low Collision Energy

16:10 – 16:50 **Coffee break**

16:50 – 17:10 **Dolf Huybrechts** (UAntwerpen)
Cluster Gutzwiller Monte Carlo approach for a driven-dissipative spin model

17:10 – 17:30 **Michaël Lobet** (ULiège)
Photonic management using opal-like crystals in perovskite solar cells

17:30 – 17:50 **Wout Van Alphen** (UAntwerpen)
Dynamics of the decay of dark solitons in superfluid Fermi gases

Astro-, Geo- and Plasma Physics

Convener: Simona Toscano (ULB), Forum-H

14:30 – 15:10 Invited talk: **Simone Russo** (European Commission, Joint Research Centre, Ispra, Italy)
Half a degree and rapid socioeconomic development matter for heatwave risk

15:10 – 15:30 **Elisa Pinat** (Royal Observatory of Belgium, Brussels)
Measuring snow seasonal variations in Antarctica with GPS

15:30 – 15:50 **Brecht Laperre** (KULeuven)
Prediction of the Dst-index using a Long Short-Term Memory network

15:50 – 16:10 **Jozef Ongena** (LPP/ERM-KMS)
Physics applications of ion-cyclotron heating on Wendelstein 7-X

16:10 – 16:40 **Coffee break**

16:40 – 17:00 **Dirk Van Eester** (LPP/ERM-KMS)
The challenge of modelling wave propagation and damping in hot, magnetised plasmas in fusion machines

17:00 – 17:20 **Aurélien Sourie** (ULB)
Constraining the interior of neutron stars with gravitational-wave observations

Physics & Education

Convener: Philippe Leonard (ULB), Room OF2070

14:30 – 15:10 Invited talk: **Domien Van der Elst**
Using Technology to provide pupils access to the best physics teachers

15:10 – 15:50 Invited talk: **Bart Huyskens (**SJI Schoten, Antwerpen)
Air quality measurement and "Internet of Things" in the STEM classroom practice

15:50 – 16:20 **Philippe Leonard** (ULB)
Challenge labs

16:20 – 16:50 **Coffee break**

16:50 – 18:00 **Philippe Leonard** (ULB)
Visit of the ULB Experimentarium

LIST OF POSTERS (*-C indicates part of the Contest)

FI-01-C **Lissa Keersmaekers** (UAntwerpen)
The Parton Branching method for transverse momentum dependent parton densities

FI-02-C **Elizabeth Rose Starling** (ULB)
GE1/1 Sustained Operations Investigations

CMN-01-C **Dietrich Elst** (UAntwerpen)
Dielectric Function Method applied to single layer graphene

CMN-02-C **Michiel Larmuseau** (UGent)
Towards deep active learning using reliable uncertainty estimates

CMN-03-C **Danny Vanpoucke** (UHasselt)
First principles calculation of vibrational spectra in solids: From fingerprinting defects in diamond to the impact of water in molecular crystals.

CMN-04 **Yves Gossuin** (UMons)
NMR relaxometry for adsorption studies: proof of concept with copper adsorption on activated alumina

BioMed-01-C **Mehrnaz M. Babaki** (LPP/ERM-KMS)
The Structure of Red Blood Cell's Aggregates

BioMed-02-C **Soroush Bakhshi Sichani** (KULeuven)
An enhanced MEMS-based gas ionization sensor by seedless growth of ZnO nanowires

BioMed-03-C **Seppe Bormans** (UHasselt)
Experimental validation of a biosensing technique which monitors thermal changes at the interface

BioMed-04-C **Alessia Gennaro** (KULeuven)
A compact device for simultaneous dielectric spectroscopy and gravimetric analysis using quartz crystal microbalance under controlled humidity

BioMed-05-C **Mehran Khorshid** (KULeuven)
Hot-wire based thermal waves technique - A novel biosensing platform

BioMed-06-C **Marijn Lemmens** (UHasselt)
Multi-frequency electrical impedance analysis for monitoring aqueous solutions using an accelerated neural network approach

BioMed-07-C **Eleonore Martin** (UMons)
Simulation of Nuclear Magnetic Relaxation Induced by Superparamagnetic Nanoparticles trapped in a biological tissue

BioMed-08-C **Gilles Oudebrouckx** (UHasselt)
Optimizing a thermal based sensor setup for monitoring physical changes of thin films over time using numerical modelling

BioMed-09-C **Wouter Stilman** (KULeuven)
Impedimetric detection of yeast using synthetic whole-cell receptors

BioMed-10 **Amirreza Gholivand** (LPP/ERM-KMS)
Analysis of red blood cells behaviour in the microfluidic device

AMOP-1-C **M. E. Cisneros-Gonzalez** (BIRA-ISAB)
Calibration facility to characterize the MAJIS/JUICE VIS-NIR detectors

AMOP-2-C **Mathilde Remy** (UNamur)
Preservation of quantum entanglement in transmission through metallic films

AMOP-3 **Raphaël Marion** (UCLouvain)
Autodetachment spectroscopy of the metastable HD- and D2- anions

AMOP-4 **Pascal Quinet** (UMons)
Theoretical study of the spectra of nine- and ten-times ionized xenon in the extreme ultraviolet region

AMOP-5 **Pascal Quinet** (UMons)
Photoabsorption and photoionization processes involving K-vacancy states of highly ionized iron atoms in high-density astrophysical plasma environments

AMOP-6 **Pascal Quinet** (UMons)
Relativistic Hartree-Fock and Dirac-Hartree-Fock calculations of radiative rates in the La I spectrum

AGP-1-C **Giorgio Sonnino and Pasquale Nardone** (ULB)
Transport Processes in Tokamak-plasmas in Fully Collisional Regime

AGP-02 **Fabrice Louche** (LPP/ERM-KMS)
Three-dimensional RF modelling of the revised ITER ICRF launcher

AGP-03 **Ragona Riccardo** (RMA)
Progress on the design of a DEMO high power ICRH travelling wave antenna mock-up to be tested on WEST

EDU-01-C **Kwinten Maes** (UGent)
Electron paramagnetic resonance characterization of vanadium dopant sites in DUT-5(Al)

EDU-02 **Shlyonskiy Vadim** (ULB)
OpenPicoAmp-open-source lipid bilayer membrane amplifier for hands-on learning of biophysics

PLENARY LECTURE ABSTRACTS

Realisation of a New Research Infrastructure in Belgium:

MYRRHA

Status and Physics opportunities in MYRRHA and ISOL@MYRRHA

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Abstract

Since 1998 SCK•CEN is developing the MYRRHA project as an accelerator driven system based on the lead-bismuth eutectic as a coolant of the reactor and a material for its spallation target. The nominal design power of the MYRRHA reactor is 100 MWth. It is driven in sub-critical mode (keff = 0.95) by a high power proton accelerator based on LINAC technology delivering a proton beam in Continuous Wave (CW) mode of 600 MeV proton energy and 4 mA intensity. The choice of LINAC technology is dictated by the unprecedented reliability level required by the ADS application. In the MYRRHA requirements the proton beam delivery should be guaranteed with a number of beam trips lasting more than 3 seconds limited to maximum 10 for a period of 3 months corresponding to the operating cycle of the MYRRHA facility. Since 2015, SCK•CEN and Belgium government decided to implement the MYRRHA facility in three phases to minimize the technical risks associated to the needed accelerator reliability.

MYRRHA is conceived as a flexible fast-spectrum pool-type research irradiation facility cooled by Lead Bismuth Eutectic (LBE), and was identified by SNETP (www.snetp.eu) as the European Technology Pilot Plant for the Lead-cooled Fast Reactor. MYRRHA is proposed to the international community of nuclear energy and nuclear physics as a pan-European large research infrastructure to serve as a multipurpose fast spectrum irradiation facility for various fields of research such as; transmutation of High Level Waste (HLW), material and fuel research for Gen.IV reactors, material for fusion energy, innovative radioisotopes development and production and for fundamental physics. As such MYRRHA is since 2010 on the high priority list of the ESFRI roadmap (https://www.esfri.eu/).

On September 7, 2018 the Belgian federal government decided to build this large research infrastructure. In this lecture we will summarize the status of the project today and we will stress the vision on how this large research infrastructure can serve the research community in Belgium and Europe and more particularly the physics opportunities thanks to ISOL@MYRRHA.

Academic research on the inertial confinement thermonuclear fusion in Europe

V. T. Tikhonchuk
Centre Lasers Intenses et Applications, Université de Bordeaux – CNRS – CEA, Talence, France
ELI-Beamlines, Institute of Physics, Czech Academy of Sciences, Dolní Břežany, Czech Republic

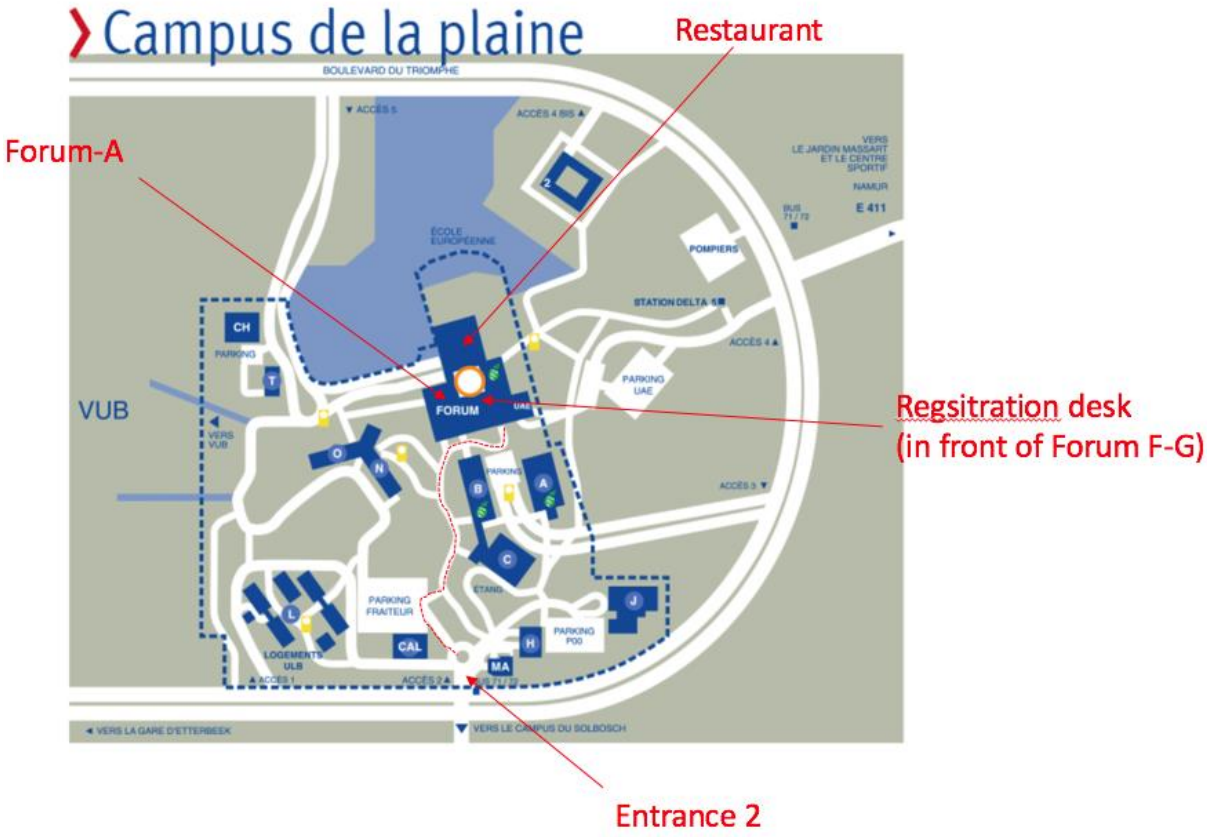
High power, high energy lasers may bring matter in extreme states of pressure and density sufficient to excite fusion of hydrogen isotopes and release a large amount of energy. Two laser system are actually capable to approach the threshold of ignition of fusion reactions: the National Ignition Facility (NIF) in the USA and the Laser MegaJoule (LMJ) in France. While construction of both large scale installations is motivated by the defense, the international scientific community profit from them to understand the underlying physical processes and to design the schemes capable to produce fusion energy. European scientists are developing alternative ignition schemes that are promising for future fusion reactors a reduced ignition laser energy, a better target performance and more efficient energy production. In spite of general attractiveness of these schemes, the experience of last 15 years of international research shows considerable challenges on the way to their practical realization. The common denominator of these problems are the energetic electrons, the physics of their generation and transport and the control of their energy deposition. In this review I present the recent advanced in the physics of energetic electron transport in application to the ignition schemes studied on the high power laser installations in the Europe, USA and Japan.

The major challenge for the fusion scheme called "fast ignition" is the divergence of the relativistic electron beam. Developed recently technique of a strong magnetic field generation with laser driven coils provides an efficient electron transport over the distance of a hundred microns and allowed to achieve a record ion temperature of 3 keV in the compressed core in the integrated experiment on the GEKKO-LFEX laser system in Japan. Hot electrons created in laser plasma interaction with solid targets at laser intensities above 10^{15} W/cm^2 can deposit their energy in depth of the target thus augmenting the strength of the shock and/or preheating the target upstream the shock. These issues are of a vital importance for the fusion scheme called "shock ignition". Our studies demonstrate the vulnerability of the standard target design to the fast electron preheat and a necessity of a better control of the hot electron generation and transport. Several results related to the control of hot electron generation and transport in the converging geometry on the OMEGA laser system at the University of Rochester will be presented as well as the design for the strong shock experiment on the LMJ facility scheduled for the April 2019.

I will conclude my talk with consideration of the future developments in the inertial confinement fusion, and in a more general sense of high energy density physics, which are related to the commissioning of the Extreme Light Infrastructure (ELI-Beamlines) in the Czech Republic. This is a new generation of high power laser systems with the laser shot rate increased by two orders of magnitude making a significant step towards the fusion energy production.

This work has been carried out within the framework of the EUROfusion Consortium and has received funding from the Euratom research and training programme 2018-2020.

MAPS



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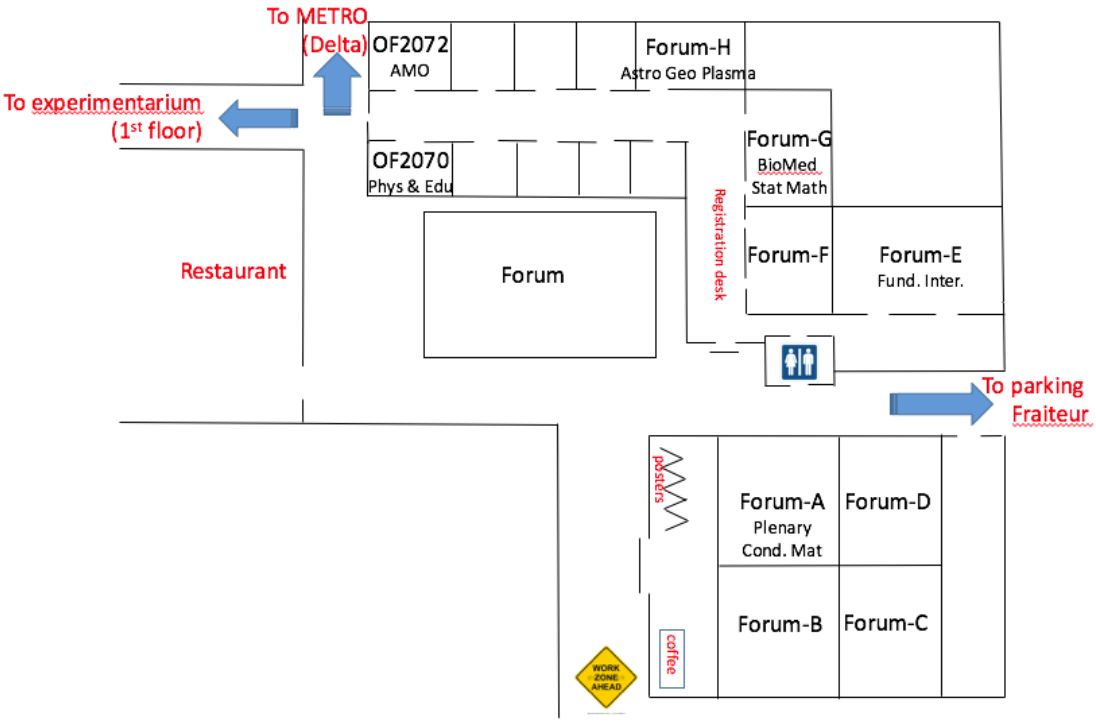

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