

Alfredo Davide FERELLA

Associate Professor

Experimental dark matter detection, neutrino physics and particle astrophysics have been the leitmotiv of my research activities. So far I participated in four experiments. ICARUS (neutrino physics), XENON (dark matter), GERDA (neutrinoless double beta decay), CASPEr (axion search). I was part of the writing team of the proposal for DARWIN, in 2009, First ASPERA Common Calls for Proposals and am one of the proposing members of PTOLEMY (Pontecorvo Tritium Observatory for Light, Early-universe, Massive-neutrino Yield) an experiment aiming at cosmological neutrino background and light dark matter direct measurement.

In my career in academia I would like to keep my original engagement in astroparticle physics. My main expertise is in :

- > detector design
- > cryogenics
- > low-level background techniques
- > advanced data analysis
- > Monte Carlo Simulations

These are the pillars of my research activities and expertise acquired up to now. I however intend to keep enlarging my “field of action” and widening the spectrum of my expertise.

Finally my other interest, together with research, is education. I am currently the responsible of two courses in the bachelor and master’s degree in Physics at the University of L’Aquila and am quite enthusiastic both about the outcome and about some new techniques based on “flipped learning” that I’m refining year after year. I’ve always believed that knowledge transfer enriches both the learner and the teacher; I experienced (and keep experiencing) it as a learner and I’m now consciously acknowledging it as a teacher.

EDUCATION

2004-2007 PhD in Physics - University of L’Aquila, Italy

Thesis title : “*Study of the Electron Lifetime in a dual-phase Xenon Time Projection Chamber for Dark Matter Research*”

Main topics :

- > Study and development of techniques to determine and monitor the contamination of electro-negative impurities in Liquid Xenon.
- > Development of a device called “Purity Monitor” for these purposes.
- > Characterization of the XENON10 Dark Matter Search detector, focusing on its response to γ -ray sources, in order to determine the energy calibration, the resolution and the evolution of the electron lifetime along the recirculation time.

1996 - 2002 Masters degree in Physics - University of L’Aquila, Italy

Thesis title : “*Measurements of electron drift velocity in Liquid Argon as function of the Temperature and Pressure*” (in Italian)

ongoing
October 2019

Associate Professor, UNIVERSITY OF L'AQUILA, Via Vetoio 10 - 67100 - Località Coppito - L'Aquila (Italy)

Research activity :

- > PI of the group and member of the XENON Collaboration Board
- > Gas Purification working group leader (XENONnT)
- > Responsible of the design and construction of a magnetically coupled piston pump to be used in the XENONnT experiment
- > Responsible of the re-design of the XENONnT gas purification system
- > Signal readout working group (WG5) leader for the DARWIN experiment
- > Collaboration in a multi-disciplinary study for the definition of new materials (namely Dirac materials) for the direct detection of sub-GeV dark matter

Teaching :

- > Classical electromagnetism for 2nd year bachelor students in Information Technology
- > Supervising a Master Student
- > Co-advisor of two PhD students and one Master student

Responsibility roles :

Working group leader Teaching responsibility Supervision of Students

September 2019

Senior research scientist, STOCKHOLM UNIVERSITY, Roslagstullsbacken 21 - 10691 - Stockholm (Sweden)

January 2015

Italian National Scientific qualification ASN as associate professor in the sector "Experimental physics of fundamental interactions" A2/01

Research activity :

- > Senior of the Dark Matter and Astroparticle Physics group (D-MAP) led by Jan Conrad : primary role in the definition of the research strategies of the group
- > Responsible of the design and construction of a cryogenic test facility for characterization of photo-sensors in liquid xenon for XENONnT and other future liquid xenon based experiments
- > Collaboration in a multi-disciplinary study for the definition of new materials (namely Dirac materials) for the direct detection of sub-GeV dark matter
- > Sub-systems integration of the CASPER-WIND experiment (measurement with NMR techniques of possible galactic axions-induced spin precession on hyper-polarized ^{129}Xe)
- > Supervising a master student in the study and optimization of the static electric and magnetic fields of the MAC-E filter of the PTOLEMY experiment

Teaching :

- > course coordinator of two courses :
 - "Detector Physics" Masters of Science in Physics
 - "Radiation Detection and Measurements Methods" Masters of Science in Medical Physics
- > Main advisor of a PhD student, two Master students and co-advisor of two PhD students

Responsibility roles :

Analysis Coordinator Operations Manager Teaching responsibility Supervision of Students

December 2014
September 2012

Research scientist, LABORATORI NAZIONALI DEL GRAN SASSO, Via G. Acitelli, 22 - 67100 - Assergi (AQ)

- > **analysis coordinator** of the XENON100 experiment
- > **Operations Manager** of the XENON project : according to the XENON MoU my main tasks were defined in this way : “responsible for the overall schedule of the XENON experiments at LNGS, including maintenance schedule necessary to insure continuous detector operation. Other tasks include, but are not limited to : coordinate and oversee the shift plan, ensuring that each person on shift is properly trained and qualified, with required permission or license as required for the safe and smooth operation of the experiment. The Operations Manager is also ultimately responsible for ensuring that all XENON personnel on-site is compliant with the safety rules of the hosting Laboratory as well as any applicable laws; finally he/she communicates any emerging operational issues to the Collaboration Board, and interfaces with the technical and engineering staff of the hosting Laboratory.”
- > Group Leader In Matter Of Safety (GLIMOS) of the XENON100 and XENON1T experiment : interface between the experiment and the Laboratory safety representatives as well as main responsible of the safety of the personnel working on the experiment
- > administrator of the XENON Common Funds
- > task group leader for material radioactivity screening and selection for the XENON1T detector (until January 2014);
- > Monte Carlo simulation of the detectors (both XENON100 and XENON1T) and background modeling;
- > responsible of a High Purity Germanium detector, used for gamma ray spectrometry (until January 2014);
- > analysis of the XENON100 experiment data;
- > active collaboration on the design, of the XENON1T detector.

Responsibility roles :

Analysis Operations manager Common funds administrator GLIMOS

September 2012
August 2010

Post-doc | UZH-Zurich University, PHYSIK INSTITUT, WINTERTHURERSTR. 190, CH-8057 ZÜRICH, Switzerland

Research activity on **Dark Matter** (XENON100 and DARWIN), **Neutrinoless Double Beta Decay** (GERDA) and **Astroparticle Physics** :

In the XENON project :

- > task group leader for material radioactivity screening and selection for the XENON1T detector;
- > active collaboration on the design, of the XENON1T detector;
- > Monte Carlo simulation of the detectors (both XENON100 and XENON1T) and background modeling;
- > analysis of the XENON100 experiment data;
- > responsible of a High Purity Germanium detector, used for gamma ray spectrometry.

In the GERDA project :

- > material screening;
- > maintenance of the calibration system;
- > maintenance of the database used for recording data quality parameters;
- > development of the detector calibration analysis pipeline;

In the DARWIN project :

- > Monte Carlo simulation task group leader;
- > material screening task group leader;
- > active participation in the detector concept design;
- > based at CERN for about one year working on a project for measuring the scintillation efficiency to low energy nuclear recoils of Liquid Argon;

Teaching :

- > Supervision of 3 PhD students
- > Basic Physics laboratory course for students of the Medical School
- > Basic Physics laboratory course for students of Biology.

Responsibility roles :

Material screening Monte Carlo Simulations Research activity at CERN Students supervision

July 2010 | Post-doc | UZH-Zurich University, PHYSIK INSTITUT, WINTERTHURERSTR. 190, CH-8057 ZÜRICH, Switzerland

August 2007 | Research activity on Dark Matter, Double Beta Decay and Astroparticle Physics :
 In the XENON project :
 – <http://xenon.astro.columbia.edu/>
 > analysis of the XENON10 prototype's data;
 > responsible of the XENON100 local operations and shift organizer for one year between 2009 and 2010;
 > task group leader for material radioactivity screening and selection for the XENON100 detector;
 > task group leader of the XENON100 photomultiplier tubes single photo-electron response calibration group;
 > active collaboration on the design, development and construction of the XENON100 detector;
 > Monte Carlo simulation of the detectors (both XENON10 and XENON100) and background modeling;
 > analysis of the XENON100 experiment data;
 > responsible of a High Purity Germanium detector, used for gamma ray spectrometry.

In the GERDA project :
 – <http://www.mpi-hd.mpg.de/gerda/>
 > material screening;
 > contribution to the calibration system development;
 > design of the database used for recording data quality parameters;
 > development of the detector calibration analysis pipeline;

Teaching :
 > Supervision of 5 PhD students
 > Advanced course on elementary particle physics laboratory : teaching and grading.
 > Assistant in the basic Physics laboratory course for students of the Medical School
 > Assistant in the basic Physics laboratory course for students of Biology.

Responsibility roles :
 Working groups responsibilities Lab assistant

July 2007 | Post-doc | RWTH-Aachen, PHYSIKALISCHES INST. B, D-52056 AACHEN, Germany

January 2007 | Research activity on the XENON project concerning the various aspects of the experiment :
 > analysis of the XENON10 prototype's data;
 > design and construction of a low background gamma-ray spectroscopy facility for material radioactivity screening (GATOR);
 > Monte Carlo simulation of the detectors (both XENON10 and XENON100);
 > collaboration on the design, development and construction of the XENON100 detector.

Responsibility roles :
 Analysis Detector Design Low-activity techniques

COMMISSIONS OF TRUST

2018 – ERC remote referee – Proposal evaluator (expert) of Consolidator grants

2007 – Ad-hoc Scientific Peer Reviewer of *Journal of Cosmology and Astroparticle Physics (JCAP, IF : 4.734)*, *Nuclear Instruments and Methods in physics research A (NIMA, IF : 1.362)*, *Journal of Instrumentation (JINST, IF : 1.310)*, *Astroparticle Physics (IF : 3.257)*, *Journal of Radioanalytical and Nuclear Chemistry (IF : 1.282)*

January 2018 – Member of the Oskar Klein Centre (OKC) Steering Board Committee

June 2016 – Convener of the Work Package 2 of OKC : “Beyond Standard Model” working group

2017 – Deputy Group Representative at the Committee for the Technical Division of the Physics Department of the Stockholm University

January 2015 – Faculty Member of the Physics Department of the Stockholm University

2013 – 2015 Administrator of the common funds of the XENON Collaboration (about 190 k€/year)

ORGANIZATION OF SCIENTIFIC MEETINGS

22/09 – 03/10/2014 Member of the local organizing committee of Gran Sasso Summer Institute 2014 – Hands-On Experimental Underground Physics at LNGS

IDM 2018	23 – 27 July 2018, Identification of Dark Matter , Brown University, Providence, Rhode Island, USA Talk : “ <i>Material informatics for dark matter searches</i> ”
IDM 2018	23 – 27 July 2018, Identification of Dark Matter , Brown University, Providence, Rhode Island, USA Talk : “ <i>The PTOLEMY-G³ experiment for light dark matter direct detection</i> ”
VULCANO WORKSHOP 2018	20 – 26 May 2018, Frontier Objects in Astrophysics and Particle Physics , Vulcano Island, Sicily, Italy Invited talk : “ <i>Dark Matter Direct Detection Experiments</i> ”
KAW100	3-5 April 2017, Big Questions in Astrophysics – the next decades – Dark Matter workshop , Lund, Sweden Invited talk : “ <i>Direct detection of Dark Matter</i> ”
Partikeldagarna 2017	6 – 7 November 2017, Swedish Physics Society, Particle physics days , Stockholm, Sweden Talk : “ <i>Axion search with the CASPEr experiment</i> ”
Partikeldagarna 2016	27 – 29 October 2016, Swedish Physics Society, Particle physics days , Gothenburg, Sweden Talk : “ <i>Direct and indirect detection of dark matter with HESS, Fermi and XENON</i> ”
Partikeldagarna 2015	27 – 29 October 2016, Swedish Physics Society, Particle physics days , Uppsala, Sweden Talk : “ <i>The XENON project for Dark Matter Direct searches</i> ”
EPS-HEP 2015	23 – 30 July 2015, 2015 Europhysics Conference on High Energy Physics , Vienna, Austria. Parallel session talk : “ <i>Looking forward : DARWIN-LXe another step beyond XENON1T</i> ”
3rd ICNFP 2014	31 July – 6 August 2014, International Conference on New Frontiers in Physics – Conference Center of the Orthodox Academy (OAC) , Crete, Greece. Invited talk : “ <i>Direct WIMP searches with XENON100 and XENON1T</i> ”
Unsolved 2014	29 June – 5 July 2014, Unsolved Problems in Astrophysics and Cosmology – Eotvos University , Budapest, Hungary. Invited talk : “ <i>Dark matter searches with XENON100 and future perspectives</i> ”
XII Edizione di IFAE	3 – 5 April 2013, XII Incontri di Fisica delle Alte Energie – Cittadella Universitaria , Monserrato (CA), Italy. Invited talk : “ <i>Recent results in Dark Matter direct detection</i> ”
25th Rencontres de Blois	26 – 31 May 2013, Particle Physics and Cosmology – Chateau Royal de Blois , Blois, France. Parallel session talk : “ <i>Dark matter searches with XENON100</i> ”
13th ICATPP Conference	3 – 7 October 2011, International Conference on Advanced Technology and Astroparticle Physics – Centro di Cultura scientifica “Alessandro Volta” , Villa Olmo, Come, Italy. Invited talk : “ <i>Recent experimental results on Dark Matter direct detection</i> ”
Seminar	20 May 2011, Friday Lunch with Astroparticle Physics - FLAP , University of Padua, Padua, Italy Seminar : “ <i>Strangers in the night</i> ”
TeVPA 2010	19 – 23 July 2010, TeV Particle Astrophysics 2010 – Cité Universitaire de Paris (CIUP) Paris, France. Parallel session talk : “ <i>The XENON100 direct Dark Matter search Experiment</i> ”
Seminar	5 April 2009, Gran Sasso National Laboratory, Assergi (AQ) , Italy Seminar : “ <i>The XENON100 experiment for WIMP direct detection</i> ”
EPS-HEP 2009	16 – 22 July 2009, The 2009 Europhysics Conference on High Energy Physics 2009 , Krakow, Poland Parallel session talk : “ <i>Status of the XENON100 experiment for WIMP direct detection</i> ”
DESY Theory workshop	29 September – 2 October 2008, DESY Theory Workshop on “Dark Matter at the crossroads” - DESY , Hamburg, Germany Parallel session talk : “ <i>Material screening and Background Expectation for the XENON100 Experiment</i> ”
PASCOS07	2 – 7 July 2007, 13th International Symposium on “Particles, Strings and Cosmology” - Imperial College , London, UK Parallel session Talk : “ <i>The XENON Dark Matter Experiment : Status of the XENON10 Phase</i> ”

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English	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
French	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Swedish	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- > Singing (Tenore)
- > Writing (inspirational writing)
- > Science communication
- > Sport (football addicted, climbing passionate)

EXPERTISES

Hardware	Building and designing systems for ultra high vacuum and cryogenic applications, high voltage, photo-sensors, charge sensitive devices.
Electronics	Micro-electronics (Op.Amp., BJT, FET, MOSFET, ecc...).
DAQ	Designing and Management of data acquisition systems.
Low-activity	Low background techniques and technologies
Simulation	GEANT4 , Spice, Comsol multiphysics, Kassiopeia
Programming	C/C++ , Python , Perl, SQL, PHP, Javascript, Unix scripting, Unix development tools, HTML, XML, \LaTeX
Operative Systems	Mac OS X , configuration of software for desktop and server use. Linux installation and configuration for desktop and server use.

OUTREACH

2004-2009 and 2013-2015	Laboratori Nazionali del Gran Sasso open day : official underground laboratory guide and experiments presentations for visiting groups
11 October 2017	Seminar entitled "Direct Detection of Dark Matter" to students from the Italian Association of Physics Students who organised the Particle and Astroparticle Physics Autumn Program partly at the Gran Sasso Laboratory
26 September 2014	co-organizer of the Treasure Hunt at the Researchers Night organized by Gran Sasso Laboratory (Sharper) done in L'Aquila
2002 -	Official Gran Sasso Underground Laboratory guide