CV Ioannis Giomataris

Απόφοιτος του Αριστοτελείου Πανεπιστημίου, 1976. Διδακτορικό στο Πανεπιστήμιο Paris-XI στην Orsay (Γαλλία), 1980. Έχει συμμετάσχει ως ερευνητής σε πολλά πειράματα στο CERN (στο ISR, στο SPS και στο LEP). Βασικός συνεργάτης στις ομάδες του Tom Υψηλάντη και του Νομπελίστα Georges Charpak. Από το 1994 είναι επικεφαλής ομάδας έρευνας και ανάπτυξης (R&D) στο ερευνητικό κέντρο Paris-Saclay στο οποίο είναι Διευθυντής Ερευνών. Εφευρέτης διαφόρων ανιχνευτικών συστημάτων και ιδιαίτερα του ανιχνευτή MicroMegas και του σφαιρικού αναλογικού απαριθμητή. Είναι επικεφαλής πολλών διεθνών συνεργασιών και διοργανωτής διεθνών συνεδρίων. Για τη συνεισφορά του στη Φυσική έχει βραβευθεί από τη Γαλλική ακαδημία.

EDUCATION:

1980 PhD thesis, University of Orsay, Paris XI

1976 DEA of theoretical physics, University of Orsay, Paris XI

1975 Diploma thesis, University of Thessaloniki

CURRENT POSITION

1998-2015 Research director CEA, CEA Saclay DSM/IRFU – France

PREVIOUS POSITIONS

1995-2008 Research physicist position, CEA Saclay DSM/IRFU – France

1993-1994 CERN consultant, G. Charpak group at CERN

1990-1992 Research associate, University of Lausanne

1988-1989 Senior research visitor, CNRS-Strasbourg

1985-1987 CERN Research Fellow, CERN

1983-1985 Research fellow position, NTU Athens

AWARDS

2000 Lauréat du prix des Sciences Physiques et Mathématiques du Comite du Rayonnement Français

2002 Lauréat du Grand Prix Jaffe de l'Académie des Sciences de France

Summary of leadership profile:

Ioannis Giomataris is the originator of numerous contributions to the instrumentation for particle physics and of several proposals for the detection of low-energy neutrinos, dark matter and other elusive particles. He has been participating in many particle physics projects and experiments. Selected projects in which he had played an exceptional role from the original idea to its realization are listed below.

- **The Trigger for Beauty**: A novel fast Cherenkov device for a first level triggers at high rate proton-proton collisions, selecting B-mesons among high-background events. Proposed in collaboration with G. Charpak and L. Lederman the new detector was developed, under Ioannis Giomataris leadership, by a large collaboration of many Institutes: CERN, Saclay, Lausanne and FNAL.

- **The Hadron Blind Detector (HBD),** proposed with G. Charpak in 1991. It is an innovation of a fast and simple Cherenkov Counter based on the new solid photocathode CsI (invented and developed by the group some years earlier) and the Parallel Plate Avalanche Counter (PPAC). The aim is to track high-energy electrons, produced in particle collisions, inside a large background of charge particles with the advantage to be practically blind to most of hadrons. Using this detector it was possible to track high transverse momentum electrons in a very high background of pions or generally hadrons. The detector was developed at CERN in collaboration with MIT and Lausanne University. Today the HBD concept is used by PHENIX experiment at the Brookhaven (BNL) high-energy ion accelerator.

- **The MICROMEGAS detector.** In 1995 Ioannis Giomataris, leading a group in Saclay, invented and started the development of the novel Micromegas detector. The structure is a miniaturized version of a very asymmetric 2-stage parallel plate detector: the gas volume is split into two regions (a drift and a narrow amplification gap) by a thin micromesh, held at a negative potential of a few hundred volts and sustained by pillars at a distance of a few tens to one or two hundred microns from an anode. The new technology enables the development of detectors with unprecedented spatial resolution and high-rate capability, which also have large sensitive areas and exhibit operational stability and increased radiation hardness. The small multiplication region is a key element in Micromegas operation, giving rise to its excellent spatial and time resolution. An interesting property of the narrow gap is that locally small variations of the amplification gap, due to gas pressure-temperature variations or mechanical defects, do not induce gain fluctuation; <u>they are compensated by an inverse variation of the amplification coefficient</u>. This effect is explained with details in the review paper by I. Giomataris, NIMA423 (1999)32. The observation formulated in a simple mathematical equation is a significant contribution towards the optimization of parallel plate gaseous detectors. It also shows that the size of the amplification gap should be adjusted with the gas pressure in order to reach an optimal operation. In the first generation of detectors, conventional mechanical assembly techniques were used to implement the micromesh and to position the planes forming the different sensitive regions. These techniques impose limitations on the size and shape of the detector, and require a large number of operations. To overcome these difficulties Ioannis Giomataris has invented new methods of manufacturing the amplification structure in a single piece.

- **Bulk Technology Micromegas.** In 2005 the applicant, in collaboration with a CERN engineer invented, a novel way to manufacture Micromegas detector, the so-called ‘bulk technology’. A simple process based on the Printed Circuit Board (PCB) technology is employed to produce the entire sensitive detector by using a woven mesh from the commercial market. After a three steps process, lamination, insulation and development, the detector core is obtained <u>as a single-compact piece</u>. Such a fabrication process could be extended to very large area detectors made by the industry. The low cost fabrication together with the robustness of the electrode materials will make it attractive for several applications ranging from particle physics and astrophysics to medicine. Moreover, this technique is suited to industrialization and mass production, thereby offering the perspective of a cheap alternative to wire chambers. Today the bulk method is the main fabrication process for the Micromegas, and it has already been used in T2K a neutrino experiment in Japan. It is also used by many other experiments or future projects: COMPASS in CERN, CLAS12 in JLAB, ATLAS-sLHC in CERN, TPC for the ILC, MiMaC a directional dark matter project, HARPO a gamma polarimeter for astronomy, FIDIAS a heavy ion detection system.

- **Microbulk technology Micromegas.** Recently the applicant has developed (patent 1) a new Micromegas manufacturing technique 'Micro-Bulk', based on Kapton etching technology. It results to a significant further improvement of the characteristics of the detector such as flexible structure, uniformity, low material budget, high radio-purity and time stability. The detector has already been used in CAST showing the lowest background level among all detectors used in this experiment. A 'transparent' Micro-Bulk detector is used by the n-TOF collaboration at CERN for neutron beam monitoring. The excellent energy resolution makes this technology attractive for future neutrinoless double-beta decay experiments and today is used by several international collaborations. Cylindrical and spherical detectors are under development.

- **Pixel Readout Micromegas.** A large collaboration between several Institutes (Nikhef, Saclay, CERN, Bonn) has developed on 2005 an elegant solution for the construction of the Micromegas with pixel readout is the integration of amplification grid and CMOS chip by means of an advanced "wafer post-processing" technology. The structure of thin (1 μm) aluminum grid is fabricated on top of an array of insulating pillars of typically 50 μm heights, which stand above the CMOS chip, forming an integrated readout of the gaseous detector.

- **The CAST experiment.** CAST is a CERN experiment, a world leader in solar axion search, using a decommissioned LHC test magnet pointing to the Sun, to trigger their conversion to photons. The applicant was involved in the CAST from the early beginning and he was appointed deputy-spokesman of the experiment since 2004. He is in the origin of the first design of the MICROMEGAS detector running in (CAST) experiment since 2002. He formed a group in Saclay and an international collaboration with CERN, Zaragoza and NCR Demokritos Institute. The detector, constructed with low radioactivity materials, has operated efficiently exploiting its good spatial and energy resolution of the detector as well as the time information contained in the pulse shape of the events. Six years ago, Microbulk detectors were also installed in the experiment achieving very-low background levels thanks to the improved performances of the detector as well as the upgraded shielding. Thanks to applicant's effort and group, two other Micromegas have been installed in CAST giving record low background level and stability. Today this detector is used by many projects in dark matter and neutrino search.

- **Neutrino physics and the Spherical Proportional Counter.** In collaboration with theoretician J.D. Vergados the applicant has proposed several new ideas in the domain of low-energy neutrino physics such as room size neutrino oscillation experiment using a strong tritium source with a good sensitivity to the neutrino magnetic moment.To perform such studies Ioannis Giomataris has invented a new detector: The Spherical Proportional Counter (SPC) a novel concept with very promising features, among which is the possibility of easily instrumenting large target masses with very low energy threshold. This could open the way of detecting low energy nuclear recoils produced by neutrino-nucleus coherent interaction. While this remains the main physics motivation for this development, a series of physics by-products have been identified. One example is supernova neutrino detection: a network of small spherical detectors distributed around the world has been proposed as a very efficient supernova detector, with very simple operation and low cost. Another by-product of the spherical SPC is to use it as a neutron detector by filling it with He-3. The device is capable to do neutron spectrometry in very low neutron fluxes, being extremely interesting to characterize neutron backgrounds in underground laboratories. The applicant has initiated a new international conference, which is held in Paris every two years since 2002 with title: 'LargeTPCs for Low Energy Detection'. The conference gathers about 120 participants and permits an extensive discussion of present and future projects using a large TPC for low energy, low background detection of rare events (low-energy neutrinos, double beta decay, dark matter, and solar axions). New ideas and projects emerged from these discussions especially in the domain of directional or light dark matter search, low-energy neutrino physics and double beta decay using high-pressure Xenon.Three years ago, in collaboration with other physicists he started organizing, every two years, a new International Conference on MPGD's (Micopatern Gaseous Detectors). In summary the applicant holds demonstrated records and leadership in his scientific domain (see also an attached annex letter by G. Charpak), and in particular:

- He has a strong Background in Detector Instrumentation (development of novel gaseous, Cherenkov counters and various particle or nuclear physics detector concepts) for radiation detection.
- Developed the Micromegas detectors, which are now widely used by a large international scientific community, and a new Spherical Detector with promising prospects.
- He has extensive experience in Project Management (Spokesman of RD30 collaboration at CERN (1992-1996), deputy spokesperson of CAST experiment at CERN, Management board of the RD51 Collaboration at CERN.
- He has strong Experience in Organization of Large International Conferences. He has initiated, with other physicists, the International Four Seas Conference, The Paris International TPC conference for rare events and the International MPGD Conference, in which he is the Scientific Program Chair.