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HONORING PROFESSOR DORIN N. POENARU ON HIS 70TH BIRTHDAY

FOREWORD

On April 9, 2006, we marked the 70th birthday of Professor Dorin N. POENARU, who is worldwide known as one of three theorists that predicted heavy ion radioactivities, as mentioned in the New Encyclopedia Britannica (1995 edition): *"In 1980 A. Săndulescu, D.N. Poenaru and W. Greiner described calculations indicating the possibility of a new type of decay of heavy nuclei intermediate between alpha decay and spontaneous fission. The first observation of heavy-ion radioactivity was that of a 30 MeV carbon-14 emission from radium-223 by H. J. Rose and G. A. Jones in 1984."*

Dorin N. Poenaru is a luminary in that constellation of scientists trained in the early days of the Bucharest Institute of Atomic Physics (IFA). They raised local research standards in physics to the point of turning their institute into a prominent national school of worldwide fame. Poenaru's importance in the elite of physics at home and beyond therefore deserves to be better known and praised.

As nuclear fission marked its 50th anniversary in 1989, Prof. Poenaru was invited to present the new ground in science he had helped break at three festive meetings held in Berlin (West Germany), Gaussig (East Germany), and Leningrad (USSR). Unlike most natural phenomena that were experimentally discovered and only later on explained by theorists, theory beat experiment to this discovery by no less than four years. H. J. Rose and G. A. Jones at Oxford reported the first measurements (^{14}C emission from ^{223}Ra) in 1984. Using more advanced equipment, scientists at Orsay, France, subsequently confirmed their experimental results. Not many Romanian scientists are cited in the Encyclopedia Britannica, and Poenaru's being one of them has to be underscored right from the start. His outstanding achievement has been reported not only in high-brow and popular science journals such as *La Recherche,* no.159/1984; *Science et Vie,* no. 808/1985; *Physics Bulletin*, no. 489/1985, and *Scientific American,* no. 3/1990, but also in major dailies such as *Frankfurter Allgemeine Zeitung.*

His Transylvanian descent left an indelible mark on his biography, steering him toward his exceptional career. His parents, Nistor and Maria Poenaru, were elementary grade teachers in the village of Suiug, Bihor. It is they that imbued him with his thirst for knowledge, taught him his eagerness to work,

the will to constantly improve himself, and a strong sense of values. Dorin attended Emanuil Gojdu High School in Oradea as a boarding student from 1946 to 1953. Grade after grade, he earned awards and was often commended for the heaps of problems in the Mathematical Gazette he used to solve. He graduated with an academic achievement diploma and went on to study at the Bucharest Polytechnic Institute Faculty of Electronics.

After graduation in 1958, he won a competition for a job at IFA's Electronics Lab for Nuclear Physics where he designed, built, and tested an overall 15 devices. Among them were: an analog instrument to measure counting rates in radiation fields; a closed circuit television system used to focus charged particle beams at the cyclotron; a pulsed power supply for photomultiplier tubes; a charge-sensitive preamplifier for semiconductor detectors, etc. In 1962, he moved to the Cyclotron Dept. where he got involved in nuclear physics experiments along with teams headed by E. Ivanov, Magda Tatiana, and N. Valcov.

Taking advantage of an Education Ministry order of 1965, he enrolled in the Faculty of Physics at the University of Bucharest. He compressed the first two years into one and graduated from the Theoretical Physics Department in 1969. He postponed his final examination, however, to 1971, in order to accept an invitation to work for one year at the Nuclear Research Center in Strasbourg, France. His work capacity and professional dedication were absolutely startling: Aside from being a student in physics, he also taught as an assistant lecturer in the Faculty of Electronics, kept his research job at IFA, and prepared his doctoral thesis in engineering.

At the same time, he would publish his work. His papers that began appearing in ISI journals in 1965 focused on the collection of electron-hole pairs in semiconductor detectors of ionizing radiation, voltage and current pulses from detectors, a new type of current-sensitive amplifier, etc. His research years in this area also materialized in two monographs, both of which were put out by the Publishing House of the Romanian Academy and one of which was translated into English.

His thesis on "Semiconductor Detectors for Nuclear Radiation" that he defended in 1968 marked his first great scientific achievement. It provided a major insight into how charges were collected and how current pulses were formed in response to nuclear radiation, and introduced a mode of operation based on current pulses. The paper earned him widespread international recognition, as witnessed by thousands of requests for reprints he received at that time where neither Xerox copiers nor online versions of the science journals were available. Along with numerous citations, it also brought him that one-year invitation to Strasbourg to work with Dr. Paul Siffert, a leading authority on semiconductor detectors for nuclear radiation.

On March 18, 1970, he married Dr. Ileana-Hania Plonski, an expert electrochemist, head of the Materials and Corrosion Testing Laboratory at

the Institute for Nuclear Power Reactors in Pitesti from 1972 to 1984. Her son, Dr. Radu Alexandru Gherghescu, has been Dorin's disciple and close coworker since 1986. All three of them are now 1st class senior researchers in the Theoretical Physics Dept. of Horia Hulubei National Institute of Physics and Nuclear Engineering (IFIN-HH, heir of the former IFA) and are intensely working on a project of excellence in dynamics of binary quantum systems.

At the Cyclotron Dept. he had joined back in the early 1960s, Dorin became part of a team that collaborated with Russian researchers at JINR Dubna Laboratory of Nuclear Reactions, a remarkable group (Polikanov, Flerov, and others) that made the discovery of spontaneously fissioning isomers. Dorin himself notably contributed to identifying and measuring the excitation energies, spins, and halftimes of some fissioning isomers. His researches in this area earned him the Dragomir Hurmuzescu Award of the Romanian Academy.

After his return from France, the Romanian authorities systematically denied him permission to travel to the West for the next 15 years, despite the many invitations he received in recognition of not just his results, but also his strong scientific stature. Niels Bohr Institute Director, 1975 Nobel laureate Aage Bohr, for example, unsuccessfully asked him to work in Copenhagen for a year. The local Communist Party committee in Bucharest also barred him from running for promotion again after he'd won his 3rd class scientist position in 1969. Benched for the next two competitions in 1976 and 1982, he had to wait to advance his career until the fall of communism. The first competition he was free again to stand was held in 1990. He won with a vengeance, jumping up two rungs at a time to 1st class scientist.

In the meantime, Dorin decided to devote his undivided attention to theoretical physics and therefore gave up electronics in 1971. He also began working toward a second doctorate in theoretical physics for which he picked asymmetric fission and fusion processes as subject area. To better resolve the theoretical problems that confronted him, he took some time to master numerical analysis. Three complex computation codes he developed made it to the Computer Physics Communications Program Library. His second doctoral dissertation, in which he demonstrated, based on his own original models, that alpha decay is a fission phenomenon, paved his way toward worldwide recognition. The concept had been growing in the back of his mind since he devised his first numerical (NuSAF) and analytical (ASAF) superasymmetric fission models in the mid-1960s.

The three earliest variants of NuSAF followed a generalization of the liquid drop models for binary systems with different charge densities. The models were originally applied to alpha decay, given the large amounts of experimental data from about 380 alpha emitters that were known back then. The ASAF model proved especially successful in the systematic study of new intermediate decay modes between alpha decay and fission. A model yielding

an analytical expression for the investigated quantity was all the more welcome as it replaced scads of painstaking calculations. In every systematic search for new modes of decay, one had to test the chances that each light nuclide out of about 250 with $Z < 28$ would be emitted by any of the ca. 2,000 parent nuclides of known mass, which led to about 500,000 combinations. The fact that the ASAF predictions were later brilliantly confirmed by the experimental findings of new radioactivities, proved that fission theory could be extended to extreme asymmetries. A new semiempirical formula, which was developed on the same basis for the alpha decay half-life, turned out to perfectly agree with the experimental data even for superheavy nuclei.

Dorin defended his theoretical physics thesis in 1980. The landmark paper he coauthored was published that same year, marking, though this was not immediately apparent, the birth of a new chapter in radioactive decay physics. The first experimental confirmations had hardly been reported in 1984 that a landslide of theoretical and experimental papers followed in its wake, so many actually that the new area of physics was shortly assigned a number of its own, *"23.70.+j Heavy-particle decay"*, under the Physics and Astronomy Classification Scheme (PACS).

Since then, new kinds of radioactivities, including the spontaneous emission of ^{14}C, ^{20}O, ^{23}F, $^{22,24-26}$Ne, ^{28,30}Mg, and $^{32-34}$Si from parent nuclei with $Z = 87$ to 96, have been experimentally confirmed at universities and research centers in Oxford, Orsay, Moscow, Berkeley, Geneva, Dubna, Argonne, Vienna, Milan, Livermore, Lanzhou, and Beijing. Moreover, the experimental values these centers have reported were in good keeping with the ASAF model developed by Dorin and his colleagues.

After 1985, various theorists in Berkeley, Moscow, Giessen, St Petersburg, Madras, Copenhagen, Milan, Chandigarh, Trieste, and Michigan, adhered to the Bucharest group's concept that emission processes can be viewed as fission events. Citations of Dorin's papers suddenly surged up in the mid-1980s and have been growing in numbers ever since, as has the interest that theorists and experimenters are taking in this new field of physics.

For the past 25 years or so, Dorin Poenaru has annually spent a few months as a visiting professor at foreign research centers, particularly at the Frankfurt University Institute of Theoretical Physics run by Prof. Walter Greiner and the Frankfurt Institute of Advanced Studies Greiner founded in 2004. Over the years, he had the privilege of working together with outstanding scientists such as G.N. Flerov and S. Polikanov (Dubna), P. Siffert (Strasbourg), E. Hourani and M. Hussonnois (Orsay), J.N. Hamilton and A.V. Ramayya (Vanderbilt University, USA), and N. Carjan (Bordeaux, France). In 1994 he won a competition for a *"haut niveau"* fellowship from the French

Ministry of Higher Education and Research, and Japan's Society for the Promotion of Science granted him a fellowship to work at the Tokai-based Advanced Science Research Center of Japan Atomic Energy Research Institute (JAERI) in 2001.

Dorin Poenaru has delivered invited lectures at many major scientific meetings around the world, including the Romanian International Summer Schools in Poiana Brasov, 1980, 1984, 1986, and 1988, and Predeal, 1990, 1998, 2000, and 2006; the YASNAP International Meeting, Dubna, USSR, 1984; the Conference of the European Physical Society, Varna, Bulgaria, 1985; the International Conference on Clustering Aspects in Nuclear and Subnuclear Systems, Kyoto, Japan, 1988; the international conferences marking the 50th Anniversary of Nuclear Fission in Gaussig, GDR, 1988, Berlin, West Germany, 1989, and Leningrad, USSR, 1989; the International Conference on Rare Nuclear Decays and Fundamental Processes, Bratislava, Czechoslovakia, 1990; Nuclear and Atomic Clusters, Turku, Finland, 1991; Nuclear Reaction Mechanisms, Varenna, Italy, 1991; the International Workshop on Dynamical Aspects of Nuclear Fission, Smolenice, Czechoslovakia, 1991; Atomic Masses, Fundamental Constants, and Nuclei Far from Stability, Berkastel-Kues, Germany, 1992; the NATO Advanced Study Institute on Topics in Atomic and Nuclear Collisions, Predeal, Romania, 1992 and 1993; Exotic Nuclei and Atomic Masses (ENAM), Arles, France, 1995; the Summer School in Collective Motion and Nuclear Dynamics, Predeal, Romania, 1995; Nuclear Physics at the Turn of the Millennium, Wilderness/George, South Africa, 1996; Nuclear Data for Science and Technology, Trieste, Italy, 1997; the International Workshop New Ideas on Clustering in Nuclear and Atomic Physics, Rauischholzhausen Castle, Germany, 1997; the International Conference Advances in Nuclear Physics and Related Areas, Thessaloniki, Greece, 1997; Fission and Properties of Neutron-Rich Nuclei, Sanibel Island, Florida, USA, 1997; Perspectives in Nuclear Physics, Atlantis Resort on Paradise Island, Nassau, Bahamas, 1998; Workshop on Nuclear Theory, Rila Mountain, Bulgaria, 1999; the 7th International Conference on Clustering Aspects of Nuclear Structure and Dynamics, Rab Island, Croatia, 1999; the 2nd International Conference on Fission and Neutron-rich Nuclei, St. Andrews, Scotland, UK, 1999; Exotic Nuclear Structures, Debrecen, Hungary, 2000; the 2nd International Symposium on Advanced Science Research, Advances in Heavy Element Research, Tokai, Japan, 2001; Specialists Meeting on an Interdisciplinary Approach to Nuclear Fission, Osaka Research Reactor Institute of Kyoto University, Japan, 2002; the 3rd International Conference on Fission and Properties of Nuclear-Rich Nuclei, Sanibel Island, Florida, USA, 2002; the Advanced Study Institute on Structure and Dynamics of Elementary Matter, Kemer, Turkey, 2003; the Carpathian Summer School on Exotic Nuclei and Nuclear/Particle Astrophysics, Mamaia, Romania, 2005; the International Symposium on Heavy Ion

Physics – Gateway to the Unknown Fundamentality – Complexity, Simplicity, FIAS, Frankfurt/Main, Germany, 2006; International Workshop on Nuclear Theory, Rila Mountain, Bulgaria, 2006; The 6th General International Conference of the Balkan Physical Union, Istanbul, Turkey; Predeal International Summer School, Collective motion and phase transitions in nuclear systems, 2006, etc. His talks at these and other meetings constantly stood out for their striking new data and approaches, earning high appreciation from the organizers and audiences alike. Impressed, French participants in a 1989 meeting in Berlin even nicknamed him *"Monsieur Radioactivité"*.

Dorin Poenaru has also given many remarkable seminars at foreign universities and research entities, such as: the Institute for Nuclear Research, Kiev, Ukraine (1983); the Theoretical Physics Laboratory, Dubna, USSR (1984); the Technische Hochschule, Darmstadt, Germany (1985); the Nuclear Physics Institute (IPN), Orsay, France (1987); the University of Tübingen, Germany (1987), the University of Tokyo (1988); the University of Mainz and GSI Darmstadt, Germany (1989); the Boris Kidric Institute, Belgrade (1990); the University of Milan (1990); the University of Giessen, Germany (1991, 1993); IPN, Orsay (1992); GSI Darmstadt, Germany (1994); the Institut de Physique Nucléaire, Orsay, France (1995); Yale University, USA (1997); Oak Ridge National Laboratory (ORNL), USA (1998, 1999); A&M University, Texas, USA (1998); the Advanced Science Research Center of Japan, Tokai, Japan (2001); the Yukawa Institute of Theoretical Physics, Kyoto University, Japan (2002); Institut fuer Theoretische Physik der Justus Liebig Universität, Giessen, Germany (2003); the Max Planck Institute for Brain Research (Interdisciplinary FIAS Colloquium), Frankfurt am Main, Germany (2004); the Centre d'Etudes Nucléaires, Bordeaux, France (2005), Giessen University (2006), etc.

His papers were published in the world's most prestigious scientific journals: *Atomic Data and Nuclear Data Tables; Nuclear Physics; Physical Review C; Physical Reveiew Letters; Zeitschrift fuer Physik; Europhysics Letters; Physica Scripta; The European Physical Journal; Nuclear Instruments and Methods; IEE Transactions on Nuclear Science; Annales de Physique* (*Paris*)*; Yadernaya Fizika; Journal of Physics G: Nuclear and Particle Physics; Computer Physics Communications; Izvestia AN SSSR Ser. Fiz.; J. Physical Society of Japan; Nuovo Cimento; Annalen der Physik* (*Leipzig*), and so forth, as well as in Romanian journals such as *Revue Roumaine de Physique* and *Studii si Cercetari de Fizica*. Prof. Poenaru's papers and citations are listed at `http://www.theory.nipne.ro/~poenaru`.

Aside from the earlier mentioned primary themes of his researches, he has also addressed other important questions and made seminal contributions to other physical areas and topics, including: the unified treatment of cold fission, heavy ion emission, and alpha decay, and the extension of this theory

to complex processes such as ternary and multicluster fission; a new method for estimating the probability of preformation as penetrability of the internal fission barrier; a universal half-life curve as a function of the potential barrier penetrability; studies on superasymmetric fission dynamics and one-, two-, and three-dimensional penetrabilities; comprehensive lifetime tables that have provided guidance to experimenters and reference data to theorists; systematic reviews of experimental results and suggestions of new experiments; a new variational calculus method for determining nuclear shapes at the saddle point; obtaining potential barriers for the spontaneous emission of heavy ions, via the macroscopic-microscopic method using the single-particle levels of the most advanced two-center model, etc.

With over 1700 citations by others, Dorin Poenaru's scientific papers enjoy high visibility worldwide. Of them, 138 have appeared in ISI rated journals and 34 in non-ISI journals – local (27) and foreign (7). His 48 invited lectures and 24 oral contributions at international scientific events have been published in the Proceedings of these meetings. He has (co-) authored 12 books, 5 of which were published in Romania, 2 each in the UK and US, and one each in Germany, The Netherlands, and Singapore. One of his best, most often cited books won enthusiastic reviews from distinguished scholars such as 1981 Physics Nobelist Kai Siegbahn and Oxford University Professor P. Hodgson.

He himself is a referee for J. Phys. G: Nuclear & Particle Physics, Nuclear Physics A, Physical Review, Physical Review Letters, and Intl. J. of Modern Physics. Several times during the 1990s, the US Department of Energy (DOE) invited him to nominate candidates for the E. O. Lawrence Award and the E. Fermi Medal. He has also served as a European Commission evaluator for FP6 and INTAS.

After 1989, Dorin Poenaru became a class-1 senior scientist and a doctoral supervisor, and served as scientific director of IFIN-HH from 1996 to 2000. From this position, he helped adopt the modern scientometric methods for evaluating research output and made a major contribution toward preparing the documentation that earned IFIN-HH's certification as a "national institute of R & D". To boost the institute's international prestige, he launched the practice of publishing annual reports in English and strengthened IFIN-HH's tradition of hosting international events on nuclear physics topics. Among them was a Symposium on Advances in Nuclear Physics held on December 9-10, 1999, to mark the 50th anniversary of institutional nuclear physics research in Romania. Next came a NATO Advanced Study Institute on Nuclei far from Stability and Astrophysics organized in Predeal, August 28-September 8, 2000. The fact that UNESCO sponsored the symposium and NATO, along with UNESCO again, the ASI was an excellent mark for IFIN-HH, which would certainly not have qualified for such funding unless experts of

both organizations had been satisfied with the high degree of professionalism they met there.

In October 1999, a total 185 scientific research institutes based in 11 EU candidate countries submitted project proposals vying for Center-of-Excellence status under FP5. IDRANAP (Interdisciplinary Research and Applications based on Nuclear and Atomic Physics), a project filed by IFIN-HH and run by Dorin Poenaru, was the only one specializing in nuclear physics among the 34 winners. Poenaru went on to coordinate the center till August 2002 when he was succeeded by Dr. Florin Buzatu, the current scientific director of IFIN-HH. As a center of excellence, IDRANAP built an impressive record: it had 338 items published, including 2 books, a section in another book, 167 papers in ISI-rated journals, 42 contributions, including 19 invited talks, at international scientific events, etc.; it hosted three international workshops and an international conference attended by 300 specialists; it was visited by 39 experts, 34 post-doc students, and 9 PhD students from Bulgaria, the Czech Republic, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, Poland, and Slovakia, on work stages of one to six months.

In December 2005, the scientific community marked 50 years since the death of Alexandru Proca, the great Romanian-born French scientist that would have well deserved to win the Nobel Prize along with H. Yukawa in 1949. Dorin Poenaru takes great credit for publicizing Proca's remarkable achievements, especially his equation of the massive vector boson field that has been named after him. Poenaru edited a comprehensive preprint on the outstanding scholar's life and work and had it distributed at home and abroad. The presentation is now available on the dedicated site of Cornell University in the US. He also talked about Proca at the National Conference of Physics in December 2005 and gave an invited lecture on the subject at the International Workshop on Nuclear Theory Rila Mountain, Bulgaria, 2006. An article on Proca's life and career by Dorin Poenaru and Alexandru Calboreanu appeared in the journal of the European Physical Society, Europhysics News (No. 5 of 2006).

Out of numerous articles, reviews, and letters extolling Dorin Poenaru's exemplary personality and scientific merit, I have selected these few lines by P. Buford Price, dean of Physical Sciences at the University of California at Berkeley, member of the US National Academy of Sciences: "Dorin Poenaru is an outstanding nuclear physicist ... I have known about his work and have corresponded actively since about 1984... The major contributions of Poenaru to the prediction and development of a new branch of nuclear physics can be seen also from his review paper, from his several chapters in the three-volume book, and from his many invited talks at International Conferences and Summer Schools. Romanian Physicists should be proud of his many achievements."

A generous, congenial nature, an extraordinary scholar with a unique combination of sharp intelligence, stupendous memory, and huge capacity for work, Dorin Poenaru has always been a worthy ambassador of IFA and Romanian science around the world and has reflected a great credit on our nation. We wish him excellent health and hope he will continue for many years to devote his keen, productive mind to physics.

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