Academician Radu Miron – Eighty Years of Life and Sixty Years of Efforts

Now, when Academician Professor Doctor Radu Miron is 80 years old, he can proudly look at the accomplishments that he has made during his scientific life. His vast and constructive scholarly work has brought him international recognition and has established him as an irrefutable leader of the Romanian school of geometry. A remarkably gifted professor, endowed with the grace of speaking, he has left an indelible mark upon numerous generations of mathematicians. Being highly concerned with the teaching of geometry at all levels, he wrote books for pupils and students, as well as monographs having a high scientific level meant for researchers.

Academician Radu Miron was born at Codăeşti, in Vaslui County, on October 3, 1927, Romania. He attends the courses of the primary school in his native village. Then he finished his high school studies at the technical school in Bârlad. In 1948 he enrolled at the Faculty of Mathematics and Physics of the "Al. I. Cuza" University of Iaşi. Here he quickly attracted the attention of the famous and exigent teaching staff, so that at the beginning of the 3rd year he was appointed an instructor and shortly afterwards he was promoted to the assistantship. A year after his graduation from the faculty he has begun preparing his Doctor's Degree - the chosen speciality being Mechanics - at the Mathematical Institute of the Romanian Academy, the

Iaşi branch, his main adviser being Academician Mendel Haimovici. Thus he begins the research activity by which he will make his mark as an extremely valuable mathematician. Steady and full of energy, he has gone through the stages of a remarkable scientific and didactic career. In 1956 he became Assistant Professor at the Faculty of Mathematics and Physics and senior researcher at the Mathematical Institute of the Academy. The following year, he received his Ph.D. in the field of Physics and Mathematics, and in 1963 he became Associated Professor at the Faculty of Mathematics and Mechanics of the "Al.I.Cuza" University of Iaşi and head of a department at the Mathematical Institute of the Academy. The same year he was awarded the Ministry of Education prize for a series of papers published in 1962. The year 1968 brought him the *Gh. Tzitzeica Award* of the Romanian Academy for his monograph *"The Geometry of the Myller configurations"*. In 1965 he became Full Professor at the Faculty of Mathematics. Between 1972 and 1976 he was the dean of the Faculty of Mathematics. In 1973 he receives the title of Doctor Docent. As Head of the Department of Geometry for several years and member of the faculty executive council, he has brought a decisive contribution to the proper carrying out of the activity in the faculty, as well as to the progress of the Romanian school of Geometry. In 1991 he was elected Member of the Romanian Academy, the highest forum of Romanian spirituality and the highest recognition which a scholar may receive. He retired from the Faculty of Mathematics in 1998 receiving the homage of his colleagues and former students and he continued to act as Consulting Professor at the Faculty of Mathematics and as Full Professor at the private University "Petre Andrei" of Iaşi.

Since 1972, Professor R.Miron has been scholarly adviser for Ph.D.Thesis. Hi was scientific adviser of more than 30 doctors of sciences from Romania, Japan, Italy, Hungary, Vietnam and more than two hundreds of master theses.

Professor Radu Miron began his scientific activity, as he himself confessed, as an *apprentice at the great school of the Iaşi Mathematics Seminar* in a period when its founders, the Academicians A1. Myller and O. Mayer, were still active. The genesis of research directions of Academician Radu Miron due to the scientefic activity of the remarkable members of the Romanian Academy A1. Myller, O. Mayer, S. Stoilow, S. Procopiu, V. Volcovici, Gh. Vranceanu, G. Moisil, D. Mangeron, M. Haimovici, D. Barbilian, N. Teodorescu and of Professors A. Climescu, I. Creanga, A. Haimovici, Gh. Gheorghiev and I. Popa, the brilliant representatives of the previous generations of mathematicians of Iaşi.

Reviewing almost two hundred fifty titles that have been published among them being 30 textbooks, books and monographs, one can clearly perceive the coordinates of evolution of the scientific and didactic thinking of Professor Radu Miron. All these reflect his inventive spirit and his special concern for the innovative and for the comprehensible. They are well known, often cited and used as basic references.

His original scholarly work falls within three main fields: the differential geometry, the applications of differential geometry, the basic elements of geometry and algebra. Professor's Radu Miron preoccupations in the three fields are closely interwoven, they have influenced, conditioned and augmented each other. In general, his

research has a theoretical character. But some of it was related to the applications in Analytical Mechanics, Theoretical Physics, Optimal Control, Biology, etc.

The first three papers in 1955 are devoted to the differential geometry of the surfaces from the tree-dimensional Euclidean space. They already had showed his interest in the geometry of the nonholonomic manifolds begining from 1953 under the influence of the works of the geometers E. Cartan, Gh. Vranceanu and M. Haimovici concerning the geometrization of the nonholonomic mechanical systems. The problem of the geometrization of the nonholonomic mechanical systems with scleronomous links that have derivative systems was still unsolved. The solving required a complicated analytic apparatus and this had made E. Cartan's assert that the problem is either impossible to be solved or it must be treated from case to case, losing thus its theoretical interest. By generalizing a method due to M. Haimovici and by inventing a special technique the young researcher Radu Miron succeeds in building a faithful geometrization of the above mentioned mechanical systems. It was expounded in detail in the thesis for his doctor's degree entitled *"The Problem of the Geometrization of the Nonholonomic Mechanical Systems"*.

The framework of the problem his Ph.D. Thesis dealt with was greatly enlarged afterwards and the methods he used were extended to the study of nonholonomic manifolds for the Riemannian spaces with nondefinite metric. Thus, after a first success in the field of applications, Professor Radu Miron returns to the differential geometry with six sizable papers devoted to the nonholonomic manifolds in Riemannian spaces. The results he has obtained are so varied and profound that one can safely assert that the theory of the nonholonomic manifolds in the Riemannian spaces is a definite Romanian creation due mainly to Gh. Vranceanu, M. Haimovici and R. Miron.

In 1960 Professor's Radu Miron research turns to a new trend that will lead him to a numerous new and interesting results and that will give him the opportunity of bringing a substantial homage to his Professors Al. Myller and O. Mayer by the continuation and the brilliant development of their work. He studied the so-called Myller configurations. The results were presented in his specific manner, that is geometrically, clearly, concisely, using an elevated language in the monograph *"The Geometry of the Myller Configurations"* published in 1966. For this monograph the Romanian Academy awarded him the *Gh. Tzitzeica Prize* in 1968.

The notion of the Myller configuration was then extended to spaces with the affine connection. The study of the Myller configurations led him to the problem of the local existence of the manifolds immersed in spaces with the affine connection. In order to solve this problem he cooperated with Prof. Dr. Dan Papuc. On this occasion they have developed a theory of the distributions in space with affine connections.

Professor Radu Miron was interested in the theory of the connections on several occasions. Starting from Norden's results concerning the conjugated connection, he introduced the notion of Norden space. Professor Radu Miron also brings a significant contribution to the theory of the Weyl spaces by the study of the conformal movements in these spaces. In the theory of G-structures, he particularly studied the

properties of the connection compatible with these. Dealing with the almost conformal symplectic structure, he determined the set of all linear connections compatible with such structures and established the main properties of this set.

The research activity in Finslerian geometry and its generalization that Professor Radu Miron has introduced have brought him great satisfaction and accomplishments both in the theoretical aspects and in their applications. This topic aroused his interest as early as the 1960's when he published two papers dealing with Finsler spaces with indefinite metric, both cited in the monograph devoted to Finsler spaces by Prof. Dr. M. Matsumoto from Japan. In 1974 he firmly comes back to Finsler spaces with an outstanding contribution by the building of a field of orthonormal frames intrinsically associated to an n-dimensional Finsler space. This field has as special cases the field of frames used by L. Berwald and A. Moor in the 2 and respectively 3 dimensions. It was called the *Miron frame* by M. Matsumoto in his monograph devoted to Finsler spaces.

The relation of friendship with Professor M. Matsumoto led Professor Radu Miron to getting deeply into the theory developed by the Japanese school, theory which he would soon include in a larger one and provide with the modern and efficient methods.

Simultaneously he has been preoccupied with the stage of the research in the Finsler geometry in Romania. At the National Conference on Geometry and Topology in Timişoara, in 1977, he gave a talk *"Finsler Geometry. Romanian Mathematicians' Contributions"*.

His talent of revealing the beauty of a subject matter stimulated the interest in the study of this geometry of a great number of participants that began studying various problems taking advantage of the advice and help of Professor Radu Miron. He himself has determined the set of metrical Finsler connections and has proved, in a simple way, the existence and the uniqueness of the Cartan connection.

Professor Radu Miron initiated *"The First National Seminar on Finsler Geometry"* at the University of Braşov in 1980. In a four-hour lecture, a text that comprised 53 pages, he offerd an original introduction to the geometry of the Finsler spaces, fusing together the influence of earlier Romanian, Japanese and French researches. In this lecture, the Finslers connection appear, for the first time, as linear connections in the total space TM tangent to a manifold M, compatible to the almost complex structure naturally associated to nonlinear connections on TM. Here he pointed out the decisive role of the nonlinear connections, as well as that of the geometric objects of Finsler type, called later distinguished geometric objects. The most important novelty in this lecture was the introduction and study of the space with metrical Finsler structures, later named as generalized Lagrange spaces.

The introduction and the study of metrical Finsler structures is Professor's Radu Miron second major original contribution to the theory of Finsler spaces. This contribution has actually modified the framework of the Finsler geometry and led to new generalizations and new points of view. The most interesting point of view which offers wide prospects, also belongs to Professor Radu Miron, who has noticed that the advanced techniques in the geometries of generalized Finsler spaces can

be used in the study of the geometry of the total space of any vector bundle. He developed, by using such techniques, an elegant theory of geometric structures and of connections compatible with these, on the total space of a vector bundle, geometrical, with easy-to-follow calculus. His co-workers from Romania, developed, applied and adapted the idea to different situations, so that the geometry of the total space of a vector bundle can be said to be Professor's Radu Miron and his co-workers' creation.

The theory of subspace in the Finsler spaces less developed because of the great volume of calculus, stimulated Professor Radu Miron to apply in this field also the new points of view and the techniques he has discovered.

His theory enjoyed a large interest at the Romanian-Japanese Colloquium on Finsler Geometry, organized by R. Miron and M. Hashiguchi, which held at the universities from Iaşi and Braşov in August 1984.

After 1970, in the Theoretical Physics there has appeared an interest in developing a Finslerian Theory of Relativity that should offer the possibility of describing anisotropy properties of space. As to this matter Professor Radu Miron had a simple idea, as all great ideas: to consider the Einstein equations in Lagrange spaces as the Einstein equations associated to the canonical metrical connection from the almost Kählerian model. By decomposing the Einstein equations from the model in the adapted frames to nonlinear connection, he obtained two sets of Einstein equations. Prof. Dr. S. Ikeda from the University of Sciences of Tokyo explained the physical foundations of the entire theory in the work published as the last chapter of the monograph *"Vector Bundles. Lagrange Spaces. Applications to Relativity"*, written together with M. Anastasiei and published by the Romanian Academy in 1987. For this monograph, the second author received the *Gh. Lazar Prize* of the Romanian Academy.

Then Professor Radu Miron has defined for the first time the Hamilton spaces which he researches as dual of Lagrange spaces. By using the Legendre transformation he determines a nonlinear connection which depends only on the Hamiltonian.

Since 1988 Professor Radu Miron has focussed more on applications of the theory of Lagrange spaces and of generalized Lagrange spaces to Theoretical Physics. He developed the theory of electromagnetism and studied the geometrical optics based on a generalization of a metric due to J.L. Synge. These researches were included in the book *"The Geometry of Lagrange Spaces: Theory and Applications"* (R. Miron, M. Anastasiei, 1994) published in the series *The Fundamental Theories of Physics (FTPH)* of Kluwer Academic Publishers. He continues entireness with a deep study of the higher order Lagrange spaces. Thus he has solved the famous problem of the prolongation of order $k > 1$ of the Riemannian space, which brings a solid contribution to the foundation of the Mechanics of the Lagrangians which depends on the higher order accelerations and creates some new geometrical models for the theory of physical fields. This study was extended to two monographs *"The Geometry of Higher Order Lagrange Spaces. Applications to Mechanics and Physics"* (R. Miron, 1997) published in the same *FTPH* series of the Kluwer Academic Publishers and *"The Geometry of Higher Order Finsler Spaces"*, published by Hadronic Press in 1998. In 2001 he published also in Kluwer the monograph *"The geometry of La-*

grange and Hamilton spaces" in collaboration with D. Hrimiuc, H. Shimada and V.S. Sabau. In 2007 his book titled *"Finsler - Lagrange Geometry. Applications to Dynamycal Systems"* joint with I. Bucataru was published by the Romanian Academy.

Professor Radu Miron published some of his works in cooperation with Japanese geometers M. Matsumoto, M. Hashiguchi, Y. Ichijio, H. Izumi, S. Kikuchi, S. Watanabe, S. Ikeda, and with members of the National Seminar on Finsler and Lagrange Geometry.

It is well-known that a profound physical theory can be constructed only on the adequate perfect geometry. New geometrical theores, proposed by Professor Radu Miron, from the logical and philosophical points of view are based on fundamental concepts of the Analytical Mechanics, Euler-Lagrange equations, Hamilton-Jacobi equations, conservation laws, Nöther symmetries, non-linear connections and its structure equations, relation of duality estabilished by the Legendre transformations, etc. Therefore the geometrical theores of Professor Radu Miron correspond to the modern spirit of Mathematics and Phisics, embrace both classical branches of the Riemann-Cayley-Cartan-Finsler geometries and new arised conceptions and problems, as well as offer the richest arsenal of well-elaborated methods of investigations.

Having a great prestige in the world of Mathematics, Professor Radu Miron has been invited to lecture by the well-known institutions of France, Great Britain, the former Soviet Union, Italy, Greece, Germany, Hungary, Yugoslavia, Japan and so on. He passionately and skillfully organized several national and internatonal conferences on geometry and topology. Professor Radu Miron is often invited as an active participant (as member of the Organizing Committee with pleanary talks) in many conferences organized in the Republic of Moldova.

The "Al.I. Cuza" University of Iaşi and the Iaşi Branch of the Romanian Academy organized the international *"Conference on Differential Geometry : Lagrange and Hamilton Spaces"* which held in Iaşi, on September 3-8, 2007. This Conference was devoted to the geometry of Lagrange and Hamilton spaces, concepts introduced and studied by Academician Radu Miron. In the opening of the Conference it was scheduled an Anniversary Symposium with the aim to evoke the achievements of the Academician Radu Miron during the almost 60 years he devoted to the mathematical education. At the same time it was put into relief the impact of his scientific creation in the today Mathematics.

Professor Radu Miron received the title of Honorific Member of the Academy of Sciences of Moldova and the title of "Doctor Honoris Causa" from the Romanian univerities of Constantza, Bacău, Oradea, Craiova, and from the Tiraspol State University of the Republic of Moldova. He also received Diplomas of Excelence from the Romanian Ministry of Education and Culture, the Academy of Sciences of Moldova, Council of Iaşi County, Council of Vaslui County, Mathematical Society of the Republic of Moldova, "Al.I. Cuza" University of Iaşi and "P. Andrei" University of Iaşi. In 2002 Professor Radu Miron has received the *Award "V. Pogor"* of the Iaşi city. In 2003 National Council CNSIT awarded him the *"Opera Omnia" Prize*, one

of the distinnguished honoring awards for Romanian research activity. Repeatedly was awarded by prestige prizes of Romanian Academy (1966, 1974, 1987) and of the Romanian Ministry of Education (1963). He has recently become Emeritus Professor of the "Al.I. Cuza" University of Iaşi.

Professor Radu Miron is a member-founder and the first President of the Balkanic Society of Geometry, a member of the American Mathematical Society, of Japan Tensor Society, Finsler Geometry Society, etc.

At the age of 80, full of vigor and optimism, the Academician Radu Miron is a prominent personality and continues to be an active presence in the academic community. As author of many discoveries that belong to Mathematics in the world and leader of a scientific school fully recognized everywhere he is a model for many generations of students and researchers.

The more complete description of the life of Academician Radu Miron and his creative scientific work is included in the following publications: [1]. M. Anastasiei. *The Mathematicean Radu Miron. His Work and Life.* – Geometry Balkan Press. Bucharest, 1998. [2]. M. Anastasiei. *The Mathematicean Radu Miron. His Work and Life at 75 Anniversary.* – "Al.I.Cuza" University Press, Iaşi, 2003. [3]. I. Ivanici and P. Marcu (ed.). *Academicieni români.* – Bucharest, 1995. [4]. *Membrii Academiei de Ştiinţe a Moldovei. Dicţionar 1961–2006.* – Ştiinţa, Chişinău, 2006.

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