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MILAN KOLIBIAR (1922 – 1994)

In April 1994, although already seriously ill, Professor Milan Kolibiar still radiated optimism; all hoped, that he would recover and return to his mathematics. On July 9, of that year he died after a four year bout with his disease. He was 72.

Professor RNDr. Milan Kolibiar, DrSc., was born on February 14, 1922, in Detvianska Huta near Zvolen – a remote and mountainous part of Slovakia in the Poľana highlands. His father was a poor peasant, and the family lived in an isolated place in the hills about 6 kilometers from the next village. Surprisingly, Kolibiar did not attend the first two years of elementary school. Instead, his teacher was a peasant from the neighbouring farm who sometimes gave instruction to children during the winter. Later, young Milan had to walk or ski to a school in the next village. He could not even dream of attending secondary school, but by the age of twelve his teacher and the local priest insisted that Milan's parents send the gifted boy for further education.

First he went to Zvolen, but the cost of lodging compelled him to change for a monastery school in Kláštor pod Znievom. In 1942, he enrolled at the new Faculty of Sciences of the Slovak University (after the war renamed again to Comenius University) in Bratislava and studied mathematics and physics. He graduated in 1946 and became a member of the Department of Mathematics, where he had a succesful academic career until his retirement in 1987.

Kolibiar obtained his doctorate (= RNDr.) in mathematics in 1950 at Comenius University. In 1965, he was granted the degree of Doctor of Science (= DrSc.), the highest possible scientific degree in Czechoslovakia from Prague's University. He rose through the ranks of Assistant (1946 – 1955), Associate Professor (1957 – 1965), Professor (1965 – 1987) and Professor Emeritus (since 1987). In 1965, he was appointed Head of the newly established Department of Algebra and Number Theory. He worked in this position till his retirement.

Kolibiar belonged to the first generation of Slovak mathematicians who graduated from the University in Bratislava. In the pre-war Czechoslovakia there were only [illegible] universities — Charles University in Prague, Masaryk University in Brno and the incomplete Comenius University in Bratislava. After the Nazi [illegible] the eastern part of Czechoslovakia was separated to form a [illegible] the Slovak Republic, with the capital Bratislava. In [illegible], the Fac- [illegible]

to study mathematics and physics. Because of lack of good professors, of tradition and connections with the research centres, it was very difficult for a young mathematician to pursue research in mathematics in Bratislava at that time.

In the face of many difficulties and uncertainties of life, Kolibiar embarked upon a scientific career after graduating from the university. In a difficult environment, he managed to teach himself advanced mathematics — influenced and inspired by Professor Otakar Borůvka from Masaryk University in Brno — who used to visit Bratislava for some years after the war. It was Borůvka who recommended that Kolibiar study lattice theory. Kolibiar and his friends, among them J. Jakubík, started an informal seminar to read the Russian translation of G. Birkhoff's book Lattice Theory. This seminar resulted in the solution of some Birkhoff's problems.

I am convinced that M. Kolibiar and all his Slovak contemporaries benefited mightily from Professor Borůvka's activities in Bratislava in the late forties and in the fifties. They got a mathematical push that lasted a decade. This is a good example of how Slovak mathematics profited from the collaboration with Czech mathematical community.

Professor Kolibiar's university career, unlike that of his western colleagues, was spent at one institution with little travel. Kolibiar and his contemporaries were not allowed to visit or study at foreign universities. Even within Czechoslovakia it was very difficult to change positions between universities or between an academic institute and a university. For these reasons, Kolibiar spent his best years in Bratislava without any opportunity to make trips to universities abroad or even to Prague.

The primary research interests of Professor Kolibiar were in partially ordered sets, lattices and universal algebra. He was particularly interested in the intersection between algebra and topology.

As mentioned earlier, in the first period of his research activity, Professor Kolibiar attacked some of Birkhoff's problems. He found, together with J. Jakubík, a partial solution of [1; Problem 8] concerning isomorphisms of lattices with isomorphic covering graphs and was fully successful in solving [1; Problem 32] of permutable congruences on loops, and [1; Problem 66] asking for the characterization of lattices by means of one ternary relation. He also gave an abstract description of those ternary operations which correspond to the median operation on lattices, answering a question posed by Birkhoff and Kiss. (See [A 1], [A 3] – [A 6], [A 9].)

Kolibiar was particularly interested in identities which characterize modular lattices within the class of algebras with two binary fundamental operations. He found two identities (cf. [A 7]) which Birkhoff [2] labelled in his comments as 'remarkable'. In [A 8] Kolibiar succeeded in describing relatively complemented distributive lattices in four different ways (extending several previous results).

In his book on lattice theory, L. A. Skornjakov [9] calls this result as the Kolibiar-Hashimoto-Grätzer-Schmidt Theorem.

Decompositions of algebras and relational structures, weak homomorphisms, convex sublattices, multilattices, intrinsic topologies on ordered sets and fixed point theorems for ordered sets were further topics dealt within Kolibiar's papers. Some of his last results were in the field of median groups. For those interested in more details I recommend the papers [5] and [6].

Let's look at some of Kolibiar's results in more detail. Recall that a covering graph, $G(L) = (E, V)$ of a lattice L is an unoriented graph (without loops), where $E = L$ are elements of $G(L)$, and the vertices $V = \{(a, b) \in L : a \prec b$ or $b \prec a\}$, where $\prec$ means the covering relation in L. Now Birkhoff's question [1: Problem 8] reads: When does an isomorphism of lattices follow from an isomorphism of the corresponding unoriented graphs? Crucial for the (partial) answer to this problem is the following characterization found in a joint paper [A 1] by Jakubík and Kolibiar:

The unoriented graphs of two finite distributive lattices S and S' are isomorphic if and only if there exist lattices A and B such that

$$S = A \times B \quad \text{and} \quad S' = A \times \overline{B}, \tag{1}$$

where $\overline{B}$ is the lattice dual to B, and $\times$ denotes the direct product of lattices.

Both authors returned to the relation (1) in several other connections and under different assumptions. For example, Jakubík [3], [4] has shown that in (1), the condition of distributivity can be replaced by modularity of one of the lattices S and S', but that semimodularity is not sufficient. Kolibiar has further shown that the lattices $\mathrm{CSub}(S)$ and $\mathrm{CSub}(S')$ of convex sublattices of S and S' respectively are isomorphic if and only if the relation (1) between S and S' is true (see [A 27]). A similar result can also be obtained for closed intervals $I(S)$ and $I(S')$ (cf. [A 31]).

As mentioned earlier, Kolibiar [A 7] has characterized the variety of modular lattices using two identities only

$$\big(x \vee (y \wedge y)\big) \wedge y = y \qquad \text{and}$$
$$\big((x \wedge y) \wedge z\big) \vee (x \wedge t) = \big((t \wedge x) \vee (z \wedge y)\big) \wedge x$$

within the variety of algebras with two fundamental operations. According to the results of R. McKenzie [8], modular lattices cannot be characterized by a single identity involving $\vee$ and $\wedge$. It is worth mentioning that R. McKenzie [8] has also shown, in contrary to the modular case, that the variety of all lattices can be characterized by a single identity, using only $\vee$ and $\wedge$.

A *median group*, $G = \big(G; (\ ,\ ,\ ), +, 0\big)$, is a group $(G; +, 0)$ with a ternary operation $(\ ,\ ,\ )$ satisfying the identities

(i) group identities,
(ii) $u + (a, b, c) + v = (u + a + v, u + b + v, u + c + v)$,
(iii) $(a, a, b) = a$,
(iv) $\big((a, d, c), b, c\big) = \big((b, c, d), a, c\big)$.

The class of median groups is larger than that of l-groups (= lattice ordered groups) when in a l-group the following "median" ternary operation

$$(a, b, c) = (a \wedge b) \vee (a \wedge c) \vee (b \wedge c)$$

is considered. Kolibiar and his student Tamara Marcisová ([A 40], [7]) found the following properties:

(2) *The l-groups satisfy the identity*

$$(x, 0, -x) = 0\,;$$

(3) *A median group is a torsion group if and only if it satisfies*

$$4x = 0\,;$$

(4) *The subdirectly irreducible torsion median groups are characterized: The cyclic groups Z_2 and Z_4 are the only subdirectly irreducible algebras;*
(5) *The direct product of median groups can be characterized with the help of some substructures.*

Perhaps the most impressive and characteristic feature of Kolibiar's professional life was his great concern for, and encouragement of, his young colleagues, especially his students. An inspired teacher, founded the so called scientific seminar for students — the first one of its kind in Slovakia. The majority of contemporary leading Slovak mathematicians of the middle generation (P. Brunovský, L. Bukovský, J. Gruska, B. Riečan) were instructed and significantly influenced in their careers by M. Kolibiar. He was personally responsible for advising at least ten CSc. (= PhD) students.

In the early sixties, M. Kolibiar, together with professor M. Novotný from Brno, decided to organize a regular workshop for algebraists from Prague and Brno on lattice theory and related topics. The first [illegible]

We can take pride in Kolibiar's activities for Mathematical Olympiad. As he heard about the Polish MO he suggested organizing something like in Czechoslovakia. His clear understanding of the importance of this competition led him to organize many local circles and seminars where the students were instructed and prepared for the MO. He was a member of the Czechoslovak Committee of the MO and headed the Slovak Committee of the MO from 1951 to 1963. Kolibiar was also active on various committees of the Czechoslovak Society of Mathematicians and Physicists (JČSMF) for twenty years.

Professor Kolibiar accepted many responsibilities at Comenius University. He was a member of the Scientific Board for Mathematics at the Czechoslovak Academy of Sciences, and member or chairman of several committees for doctoral dissertations. He was also a member of editorial boards of the journals Acta Mathematica Universitatis Comenianae and Mathematica Slovaca.

Outside of mathematics, Professor Kolibiar was a man of many interests and accomplishments. He enjoyed classical music and loved to visit opera and concerts. He had a special passion for poetry. He was also very much an outdoorsman and practised swimming in summer and skiing in winter.

Kolibiar's daughter and son are researchers in electrical engineering and physics, respectively. His wife, Blanka, is a retired mathematics professor from the Technical University in Bratislava.

Throughout his career, Professor Kolibiar was the ultimate gentleman. Thoughtful and wise, he usually gave more than he received. He was always ready to help and to act against injustice even when such actions meant a danger for himself. Had he lived a few decades later, he may have had fewer personal battles, and his contributions to mathematics may well have been much greater. We loved him for his friendliness, humor and willingness to offer advice or help. We shall all miss him as a talented mathematician, a first rate lecturer, a good organizer, and a valued colleague. I will miss him most as a friend.

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