Nikola Cindro (1931 – 2001)

# Nikola Cindro in memoriam

This issue of the journal FIZIKA B is dedicated to the memory of Professor Nikola Cindro.[1]

Nikola Cindro, Senior Scientist at the Ruđer Bošković Institute, Zagreb, Professor of Physics at the Universities of Zagreb and Split, former Vice President of the European Physical Society, past President of the Croatian Physical Society, died in Zagreb on March $25^{\text{th}}$, 2001.

Nikola Cindro was born in Split, Croatia, on August $31^{\text{st}}$, 1931, in a noble family that was mentioned in the municipality archives in the early $13^{\text{th}}$ century. He studied at the University of Zagreb, where he obtained his B.Sc. degree. In 1954 he joined the Ruđer Bošković Institute, where he worked till his retirement in 1998. He prepared his Ph.D. thesis at MIT (Cambridge, U.S.A.), where he closely collaborated with H. Feshbach, and received his Ph.D. in nuclear physics from the University of Zagreb in 1959. In 1972 he founded and directed the Laboratory for Nuclear Spectroscopy (later renamed to Laboratory for Heavy-Ion Physics) of the Ruđer Bošković Institute, which was his second home throughout his whole scientific career.

Nikola Cindro's early interest in physics was in fast-neutron induced nuclear reactions. He was a member of the small group of physicists who, in the fifties and sixties, made the name of the Ruđer Bošković Institute world-wide known. With exceptional energy and enormous enthusiasm, despite limited material support, in a short time he made a reputation for nuclear physicists who, in a single year, published the largest number of papers on fast-neutron nuclear data. This work is summarized in Ref. [22] (see the attached list of publications). With continuous endeavor to work on front line topics, already in the mid-sixties his interest turned to nuclear spectroscopy and experimental verifications of the nuclear shell model. His contributions to this field: singling out the principal modes of excitation of nuclei are summarized in several review papers [26,27,30]. In the early seventies, owing to the impact of the discovery of pre-equilibrium emission, he turned again to reaction mechanism studies. Among other results, this work led to the discovery of a non-equilibrium component in (n,2n) reactions [40] and to the insight how the excitation energy of a nucleus-nucleus collision is shared among degrees of freedom in its early stages [77].

During the last 25 years interest of Nikola Cindro was concentrated on heavy-ion reactions. The first success in the field was the discovery of the fragmentation of 'gross resonances' in the $^{12}\text{C} + ^{12}\text{C}$ reaction [47], followed by the development of a model that explained it in terms of the rotation-vibration coupling in the composite nucleus [49]. He studied heavy-ion resonances in several laboratories: CEN Saclay, CE Bruyères-le-Châtel, Los Alamos NL, INP Demokritos, CRN/IReS Strasbourg,

[1] We are grateful to all authors for dedicating their scientific papers to Professor Nikola Cindro.

LN Legnaro and LNS Catania. About the same time Nikola Cindro developed the so-called orbiting cluster model [53,57], based on the 'molecular window' concept of W. Scheid and W. Greiner. This phenomenological model which predicts the occurrence or absence of resonances in a given nuclear system and the general trend of their gross structure has very successfully served as the guide to experimental investigations during the last two decades (cf. U. Abbondanno, Phys. Rev. C **43** (1991) 1484, *The persistent success of the orbiting-cluster model*). In collaboration with W. Greiner he predicted hyperdeformation in nuclei [64]. He established a group of active collaborators in Zagreb often dubbed the Zagreb school of heavy-ion physics.

Nikola Cindro and his group were from the very beginning and are still involved in the large international FOPI collaboration at the GSI Darmstadt, studying entropy production, flow phenomena, particle production and in-medium effects in relativistic heavy-ion collisions. Considering that the international collaboration in science is essential for peace and development, he visited and worked at leading nuclear laboratories in U.S.A., France, Germany, Italy and Japan and delivered invited and summary talks at numerous international conferences. He was Honorary Editor of *Heavy Ion Physics* and a member of the Editorial Council of *Acta Physica Slovaca*.

Parallel to his research work Nikola Cindro developed an educational and organizational activity. He was actively engaged in teaching at the Universities of Zagreb and Split (courses in general physics) and Graduate School of Physics, University of Zagreb (courses in nuclear physics). He is the author of a textbook in general physics for students at faculties for engineering, the first in the Croatian language after many years – that is still now, after decades and numerous editions, extensively used at Croatian universities. In 1970 he was elected President of the Society of Mathematicians and Physicists of Croatia. He also served as a member of the Council and of the Executive Committee of the European Physical Society (1971–74) and as its Vice President for 1973. He organized a series of the well-known international conferences on Nuclear Physics held in Croatia: Hvar, Dubrovnik, Brijuni Islands, Rab and the Plitvice Lakes, which, owing to their scientific impact, pleasant social atmosphere and contacts of physicists from the West and the East have significantly influenced nuclear and, in particular, heavy-ion physics, during the last thirty years.

Nikola Cindro was a strong personality. He was often met with support, but also with obstruction. However, he was never discouraged. He imparted his new ideas to others, stimulating them. He firmly adhered to his chosen course that led him to his aim: advancement and promotion of science. Thus, he contributed to science in Croatia and to the scientific community all over the world. Nikola was also a person of a broad cultural horizon and interest and, in many ways, with an astonishing knowledge of history, literature, music .... The national and international community have recognized his merits by awarding him several distinguished awards presented by the President of Croatia, Croatian Parliament, Croatian Academy of Sciences and Arts, Prime Minister of the French Republic

and others.

The best summary of his activity was given recently by R. A. Ricci, the former President of the European Physical Society, saying that by his work and personality Nikola Cindro has set Zagreb and his country Croatia on the world map of fast-neutron and nuclear heavy-ion physics.

After Nikola's death, numerous tributes from physicists around the world have reached his family and us emphasizing Nikola's numerous achievements and expressing personal memories and the deep loss they feel. He founded and headed our Laboratory at the Ruđer Bošković Institute and constantly took care of its future. We miss him most. We have lost a friend and a spiritual father.

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