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PREFACE

The contributions to the present volume are based on talks delivered at the workshop "Classical and Quantum Integrability" held at the Banach Center in Warsaw from August 27, 2001 to September 1, 2001. The workshop was organized to honour Włodzimierz Tulczyjew on the occasion of his 70th birthday.

The subject of the workshop reflects his life long work: the problem of the relation between classical and quantum mechanics, the quantum-classical transition was always at the top of Tulczyjew's scientific interests. Almost all of Tulczyjew's scientific activity was, and still is, motivated by the problem of how to reconcile ideas of relativity with those of quanta, perhaps the most important problem in theoretical physics of today. Tulczyjew was never satisfied with formal (technical) improvements in this field and never accepted partial answers to the problem. He has boldly called in question commonly accepted opinions and looked for original solutions. This approach made Tulczyjew go back to fundamentals of classical mechanics and the calculus of variations.

Some of his widely recognized discoveries are: the double Lagrange complex (solving the inverse problem in the calculus of variations); canonical isomorphisms (known as the Tulczyjew triple) which form the basis for Lagrangian and Hamiltonian mechanics and for the Legendre transformation; the role of symplectic relations in physics; and an affine framework for mechanics. He was among the pioneers in the application of symplectic geometry to physics. He started research in this field several years before the publication of J. M. Souriau's book "Structure des systèmes dynamiques" (1969), which is usually considered as precursory. Tulczyjew was one of the first (or perhaps the first) to understand the geometric meaning of "weak equalities" introduced by Dirac. He also gave a complete symplectic classification of constraints.

Another topic, always present in Tulczyjew's research programme, is the problem of gauge-independent descriptions of charged particles interacting with gauge fields. We should mention here his important contributions to the Kaluza–Klein approach and the completely original approach based on affine objects (affine valued geometry), recently being rediscovered by other authors. This list of Tulczyjew's fundamental achievements is far from complete. Moreover, not all of his results have appeared in a published form; much of his output was made known through seminar presentations and discussions with his collaborators.

We open the volume with one of those never published notes, prepared in 1961 for a series of seminars at Lehigh University, Bethlehem, PA. This paper, written forty years

ago, is very modern in spirit. Quantum mechanics is presented from the point of view of group algebras, making it very close to the current treatment of quantum mechanics on phase space and its reduction to Lagrangian subspaces. The second paper by Tulczyjew included in this volume, "The Origin of Variational Principles", which provides a conceptual framework for variational formulations of classical physics, could be considered his scientific *Credo.* These articles show the strength of Tulczyjew's ideas and a richness of imagination which have provided an inspiration to many mathematicians and theoretical physicists.

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