

FOREWORD

This collection of articles constitutes the proceedings of the conference *Concepts in Strongly Correlated Quantum Matter* (CSCQM), held at Jagiellonian University in Kraków, Poland, on November 20–22, 2025. The meeting was organized on the occasion of Professor Józef Spałek Scientific Jubilee (marking half of a century of his exceptionally successful academic career, counted from the defense of his Ph.D. dissertation in 1975), which also coincides with his 80th birthday. The CSCQM conference is the second one honoring the Professor, following the XII National School “Correlated Electron Systems Then and Now” (Ustroń, Poland, September 14–18, 2006) that was dedicated to him on the occasion of his 60th birthday. Its proceedings were published in *Acta Physica Polonica A* [1], with several authors contributing to both the former and present Special Volume.

The main topics of the CSCQM conference included:

- high-temperature superconductivity and other highly correlated systems,
- linking magnetism with superconductivity in nano- and macro-systems,
- critical phenomena in superconductors and superfluids,
- exotic metallic states in topological systems,
- dynamic effects in highly correlated systems,
- applications of conventional and exotic superconductors,

with a particular focus on highlighting the Polish contributions to those areas. The conference started on November 20 with an afternoon session featuring a lecture by Professor Spałek, entitled «From spins to condensed matter physics and beyond», followed by a live demonstration of high-temperature superconductivity in copper oxides. This opening session gathered over 100 participants, including representatives of Jagiellonian University and AGH University of Krakow authorities, distinguished researchers affiliated with 15 Polish universities and research institutes, as well as Professor’s friends and family. The recording of this event is available online [2]. The program for the two remaining days of the conference included 25 invited lectures and 6 poster presentations that formed the basis of the present volume. In these proceedings, articles have been arranged according to the order of lectures in the conference program.

The graphics presented on the book cover reflect Professor's selected scientific interests and achievements. All handwritten equations have been digitized from the 1976 preprint [3] detailing the original derivation of the now canonical t - J model of strongly correlated lattice fermions. Those results were published the following year in a seminal paper in *Journal of Physics C* [4]. The drawing on the front page of the cover illustrates the so-called t - J - U -(V) Hamiltonian. The latter describes strongly correlated electrons hopping in a lattice, interacting via both Coulomb repulsion and explicit antiferromagnetic exchange (all marked inside the figure). The original version of this illustration comes from the Ph.D. thesis of Marcin Wysockiński, completed in 2015 under the supervision of Professor. Subsequently, it has been presented (with modifications) on many occasions by the Professor to explain the details of the theoretical models employed.

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Editors of the Proceedings:

Danuta Goc-Jaęło
Maciej Fidrysiak
Piotr Kuterba

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