

Preface

These proceedings comprise the invited lectures of the third international symposium on Emergent Quantum Mechanics (EmQM15), which was held at the Vienna University of Technology in Vienna, Austria, 23–25 October 2015.

The symposium convened at the Festsaal and the adjacent Boeckl-Saal of the Technical University, and was devoted to the open exploration of the quantum state as a reality. The resurgence of interest in ontological quantum theory, including both deterministic and indeterministic approaches, challenges long held assumptions and focuses on the following questions: Is the world local or nonlocal? What is the nature of quantum nonlocality? If nonlocal, i.e., superluminal, influences exist then why can't they be used for superluminal signaling and communication? How is the role of the scientific observer/agent to be accounted for in realistic approaches to quantum theory? How could recent developments in the field of space-time as an emergent phenomenon advance new insight at this research frontier? What new experiments might contribute to new understanding? These and related questions were addressed in the context also of a possible deeper level theory for quantum mechanics that interconnects three fields of knowledge: emergence, the quantum, and information. Could there appear a revised image of physical reality from recognizing new links between emergence, the quantum, and information? The symposium provided a forum for considering (i) current theoretical and conceptual obstacles which need to be overcome as well as (ii) promising developments and research opportunities on the way towards realistic quantum mechanics. Contributions were invited that present current advances in both standard as well as unconventional approaches.

The EmQM15 symposium was co-organized by Gerhard Grössing (Austrian Institute for Nonlinear Studies (AINS), Vienna), and by Jan Walleczek (Fetzer Franklin Fund, USA, and Phenoscience Laboratories, Berlin). After two successful conferences on the same topic in 2011 and 2013, the partnership since EmQM13 between AINS and the Fetzer Franklin Fund in producing the EmQM15 symposium was able to further expand interest in the promise of emergent quantum mechanics.

The articles contained in these proceedings represent the talks of the invited speakers as written immediately after the symposium. The volume starts with an introductory statement by organizers Jan Walleczek and Gerhard Grössing, explaining why emergent quantum mechanics is a promising approach in quantum foundations. The conference proceedings then continue with the presentations as given in their chronological order, as far as they were submitted. The papers by F. Scardigli and T. Nieuwenhuizen were not presented, but are added here as additional contributions to the group of papers on gravity and emergent spacetime. Note that the talks of all speakers are freely available on the conference website (<http://www.emqm15.org/>) and on <http://www.fetzer-franklin-fund.org/> as video presentations.

The organizers wish to express their gratitude to Siegfried Fussy and Herbert Schwabl from AINS for the organizational support. The organizers also wish to thank Bruce Fetzer, President and CEO, John E. Fetzer Memorial Trust, and the Members of the Board of Trustees, for their strong support and for funding this symposium.



The expertise of the Members of the Scientific Advisory Board of the EmQM15 symposium, Ana María Cetto (Mexico), Lajos Diósi (Budapest), Maurice de Gosson (Vienna), Theo Nieuwenhuizen (Amsterdam) and Helmut Rauch (Vienna), is also gratefully acknowledged.

Finally, it is a pleasure to once more thank Sarah Toms and her team at IOP Publishing (Bristol) for their continued support during the preparation of these proceedings..

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The front cover image shows three bouncing oil droplets on an oscillating oil surface, as they are employed by Couder, Bush, Batelaan and others to show macroscopic analogues of wave-particle complementarity (courtesy of Dan Harris and John Bush, MIT).