

Preface

Following a successful relocation to Gasthof Hotel Lamm in 2017, the international symposium “Symmetries in Science XVIII” (a series initiated by Bruno Gruber in 1979) again took place in this very hospitable environment from August 4-9, 2019 in Bregenz, Austria. Thirty-seven scientists from 13 countries, more than half from outside the European Union but all over the world, reflected the truly international scope of this conference.

Again, the mixture of well-established experts and young newcomers provided a very stimulating atmosphere for lively, constructive discussions, not only in the lecture room but also outside, often till late at night (or even early morning).

As in the past, the topics covered a very broad range – from very small (elementary particles) to extremely large (cosmological problems).

A majority of the participants contributed to these proceedings though some were unable to do so as their results were either previously submitted or published elsewhere. In order to make these contributions also available to readers of the Proceedings, we list the respective references as follow:

- Goldin G A 2004 Lectures on diffeomorphism groups in quantum physics. In J Govaerts et al. (eds.), *Contemporary Problems in Mathematical Physics: Proceedings of the Third Int'l. Conference, Cotonou, Benin*, pp. 3-93 (Singapore: World Scientific).
- Goldin G A 2012 Quantum configuration spaces of extended objects, diffeomorphism group representations, and exotic statistics. In *Geometric Methods in Physics: XXX Workshop, Białowieża, Poland*, pp. 239-251 (Basel: Springer).
- Goldin G A and Sharp D H 2018 Diffeomorphism group representations in relativistic quantum field theory. In *Geometric Methods in Physics: XXXVI Workshop, Białowieża, Poland*, pp. 47-56 (Basel: Springer).
- Goldin G A and Sharp D H 2019 Diffeomorphism group representations in nonrelativistic and relativistic quantum field theory: Some future directions *J. Phys.: Conf. Ser.* **1194** 012037.
- Núñez-Valdez M, Allahyari Z, Fan T and Oganov R A 2017/2018 Efficient technique for computational design of thermoelectric materials *Com. Phys. Comm.* **222** 152-157, <https://doi.org/10.1016/j.cpc.2017.10.001>.
- Núñez-Valdez M and Spaldin N A 2019 Origin and evolution of ferroelectricity in the layered rare-earth-titanate, $\text{R}_2\text{Ti}_2\text{O}_7$, Carpy-Galy phases *Polyhedron* **171** 181-192, <https://doi.org/10.1016/j.poly.2019.07.018>.
- Núñez-Valdez M, Efthimiopoulos I, Taran M, Müller J, Bykova E, McCammon C, Koch-Müller M and Wilke M 2018 Evidence for a pressure-induced spin transition in olivine-type LiFePO_4 triphylite *Phys. Rev. B* **97** 184405, <https://doi.org/10.1103/PhysRevB.97.184405>.



- Núñez-Valdez M, Bruschini E, Speziale S, Bosi F, Fregola R A, D'Ippolito V and Andreozzi G B 2018 Reexploring the cation ordering and magnetic cation substitution effects on the elastic anisotropy of aluminum spinels *J. App. Phys.* **124** 175901, <https://doi.org/10.1063/1.5050064>.
- Werther M and Großmann F 2020 Apoptosis of moving nonorthogonal basis functions in many-particle quantum dynamics *Phys. Rev. B* **101** 174315, <https://journals.aps.org/prb/abstract/10.1103/PhysRevB.101.174315>.

Several talks can also be viewed on the conference website.

As our colleague Alejandro Frank had to withdraw his participation at short notice but had prepared his contribution particularly for our symposium, we also include it in the Proceedings.

Thirty-two lectures were given in four morning and four afternoon sessions. In addition, there were two evening lectures, one given by H.-D. Doebner reminiscing on the development in our field after World War II and his contribution and a public lecture by Francesco Iachello, showing the importance of symmetry from the early cultures to modern physics.

In a surprise lecture as part of the conference excursion, Massimo Blasone presented his view on the interrelation of physics, colours and music, applying his approach to Chopin's Etudes Op. 10 # 1 & 3 and Op. 25 # 1. Soprano Kateřina Fürstová complemented this presentation with vocal pieces by Chopin and Schubert and the afternoon culminated in a Chamber music performance by the "Blaue Blume". All this would not have been possible without a grand piano and so we are grateful to the Schwarzenberg Parish Council and Tourist Office for letting us the Angelika-Kauffmann-Hall (usually hosting the Schubertiade festival) with its Steinway grand piano under very fair conditions.

Thanks also to "Symmetry" (an Open Access Journal by MDPI) for sponsoring the coffee breaks for participants and we are especially grateful to the Schenk Family, owners and operators of Gasthof Hotel Lamm, who supported the conference since we took over in 2009. In addition to providing the wonderful and well-equipped setting to host and accommodate our symposium and its participants, they once again donated a lavish and delectable conference dinner.

Finally, we extend sincere thanks to Yvette for the preparatory work and support during the conference and her persistent help and interest in producing these Proceedings.

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