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PREFACE TO THE SPECIAL ISSUE OF ACTA POLYTECHNICA "ANALYTIC AND ALGEBRAIC METHODS IN PHYSICS"

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In September 2021, the XVIII$^{\text{th}}$ continuation of the series of the international, mathematically oriented conferences "Analytic and Algebraic Methods in Physics" (AAMP) had to be organized, for well-known reasons, online. Fortunately, every cloud has a silver lining: the related reduction of the capacity of the scientific communication channels led to the willingness of the participants to return to the recently almost abandoned tradition of complementing the Zoom-mediated meeting by a subsequent preparation of an AAMP-oriented Special Issue (SI) of Acta Polytechnica.

The main purpose of this SI is twofold. Firstly, it is intended to offer, in written form, a sufficiently representative sample of what has been presented online. This means that in the form of the standard refereed papers, the readers of this SI will be rewarded by the up-to-the-minute information about the current state of art. Secondly, in an ambition which reaches behind the meeting itself, the contributing authors felt motivated by the idea that a compact and comprehensible presentation of their results might find a broader readership among people who would not normally participate in the conference but who could still find at least some of the presented results potentially relevant for their own field of research.

In comparison with the AAMP meeting itself (where the separate subjects covered by 36 talks have been subdivided into 12 sections), a minor disadvantage of our present SI lies, from the point of view of its readers at least, in the (traditional) alphabetical ordering of the contributions by their first authors. Fortunately, interested readers might get more info about the subdivisions of the subjects via the webpage of the conference [1]. Another weakness of the SI collection could be seen, mainly by the 75 AAMP participants themselves, in an incomplete coverage of the talks. Indeed, roughly one third of them was not eligible for our SI because the material was based on the recently published papers. Again, the related complementary information is available via the AAMP homepage [1].

This being said, the readers of this SI are expected to make their own selection of the consumption out of the menu. All of the papers belong to the AAMP framework, but even such a restriction admitted the inclusion of a broad spectrum of subfields, which are all bridging the gaps between the existing abstract mathematical structures (ranging from our understanding of ordinary differential equations up to the applications of the various forms of symmetries, antilinear symmetries, supersymmetries and nonlinearities) and their possible practical implementations (ranging again from multiple elementary models and methodical considerations up to certain fairly complicated phenomenological questions as encountered, say, in the relativistic quantum field theory).

In the AAMP context, we could speak about the tradition of the search for a deeper understanding of the connection between mathematics and physics. This led, in 2007, to the formulation of the project and to the organization of the series of the dedicated international conferences. At that time, indeed, the analytic and algebraic methods were particularly actively developed by the Founding Fathers from the Nuclear Physics Institute of the CAS in Řež. In this sense, the mathematical side of the bridge to physics has been (and, in fact, it is still being) restricted to the analytic and algebraic methods. In parallel, the physics side of the same bridge proved quickly growing with time. At present, its scope covers so many parts of physics that even the originally tacitly assumed specification "quantum physics" would and could be considered over-restrictive.

One can only conclude that the interaction between mathematics and physics remains enormously productive. We believe that our SI will contribute to this productivity, counteracting the extent of damages caused to the scientific world by the coronavirus. One of its most damaging effects was, indeed, the interruption of many regular series of international conferences, of which the series "Analytic and Algebraic Methods in Physics" (AAMP), regularly taking place in Prague every year, is just one of many examples. In fact, the original hopes that the interruption might only last one year were not fulfilled.

Equally disappointing proved to be our slow but definite empirical discovery that the success and efficiency of the transformation of these conferences into virtual meetings (mediated, say, by Zoom) remains limited. What was saved was only a form, not the full contents; not the essence. We all revealed that there exists no real substitute for the face-to-face meetings, converting the hours of isolated research performed by individuals into an exchange of ideas and providing a platform for their critical re-evaluation. Creating a genuine living science which can acquire its final, collective and truly creative character only after multiple informal debates and only after multiple active personal interactions.

For all of these reasons, the organizers of the AAMP series came to the conclusion that one of the possible reactions to the unpleasant current circumstances would be an enrichment of the internet-mediated standard

form of the meetings (in which one listens to talks for a few days, without having a real opportunity of discussing the subjects in the couloirs) via a return to an apparently obsolete practice of a subsequent preparation and publication of at least some of the talks in their written, more lasting and better accessible form, better suitable for the subsequent critical re-evaluation.

In this special issue of Acta Polytechnica, the readers will have the opportunity of seeing and, perhaps, appreciating the result. Surprisingly, many speakers decided to contribute. For us, this is a proof that the production of special issues characterized by a well-defined and not-too-broad range of subjects still makes sense.

On behalf of organizers, the guest editors of the special issue,

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References

[1] http://www.ujf.cas.cz/en/departments/department-of-theoretical-physics/events/conferencies/AAMP/index.html