

PREFACE

The 45th Congress of Polish Physicists took place for the eight time in Kraków between September 13–18, 2019, under auspices of the Polish Physical Society. The Congress inaugurated the centennial year of the Society. The Special Centennial Congress was supposed to take place in April 2020, but the outburst of the Covid-19 epidemic forced the Physical Society to postpone it till late fall 2020. The Congress is organized every two years starting from 1923, with the break for the years 1939–1945, caused by the II World War, when our country was under the German occupation.

In these proceedings, we publish the accepted contributed talks and posters presented during the Congress. Some of the plenary talks have been published separately in the Jubilee issue of *Acta Physica Polonica B* (Vol. 51, No. 5 (2020)); two of the talks (those of Professors Michał Heller and Andrzej K. Wróblewski) are published in Polish in *Postępy Fizyki*. Apart from that, a round table discussion entitled: *Borders of Physics* (*Granice Fizyki*), as well as, a half-day special session of *Popular Physics* have been organized. The Congress and, in particular, the special sessions enjoyed a degree of popularity by the public at large, likewise the special concert entitled: *Na styku dwóch nieskończoności* (*At the intersection of two infinities*). Also, a special concert of algorithmic music entitled: *Oscylacje. Propagacje. Transformacje* (*Oscillations. Propagations. Transformations*) preceded the banquet on Monday evening September 16, 2019.

Our meeting had recorded a number of 683 participants. It consisted of 40 plenary talks, 190 contributed talks held in up to 5 parallel sessions, and almost 150 poster contributions. The number of scientific centers, whose representatives participated in the conference, amounted to 66. The Publication Committee thanks cordially to all the participants and, in particular, to session chairpersons, who organized most of the oral sessions with invited/contributed talks. Complete list of the sessions together with the session Chairpersons is included in these proceedings.

The Congress started with the addresses of President of the Polish Physical Society, Prof. Leszek Sirko, and continued with the award ceremony of the Society prizes for the 2019. It contained also the special awards of the German–Polish Smoluchowski–Warburg prize to Prof. Peter Hänggi (Würzburg University) and of the Marian Smoluchowski Medal in Physics to Prof. Józef Spałek (Jagiellonian University).

The two awardees have delivered special lectures, published in the Jubilee issue of *Acta Physica Polonica B* Vol. 51 No. 5 (2020). The awarding ceremony and lectures were followed up by the special lectures of two Nobel laureates: Prof. Dan Shechtman (Technion, Haifa) on the development of the idea of quasicrystals and Prof. Frank Wilczek (MIT, Cambridge, MA) on axions in elementary particle physics. The latter lecture began with an announcement of the establishment of the Frank Wilczek Prize in Physics, funded jointly by the Jagiellonian University and the Tadeusz Kościuszko Foundation (USA). The first prize is to be awarded in 2020.

A number of special centennial medals were awarded at the end of the ceremony.

The Congress Program included the Conference on Didactic in Physics, as well as a two-day segment of sessions: *Physics–Industry–Innovations*.

From the organizational point of view the whole Congress was taking place in three locations: at the Auditorium Maximum of the Jagiellonian University (13–15/09/2019), at the Faculty of Physics and Applied Computer Science of AGH University of Science and Technology (16/09/2019), and at the Faculty of Physics Astronomy and Applied Computer Science of the Jagiellonian University (17–18/09/2019). We are grateful to the Deans: Prof. Ewa Gudowska-Nowak (UJ) and Prof. Janusz Wolny (AGH UST) for making the premises of the Faculties available free of charge for the Congress sessions and ceremonies.

On September 17, 2019, the Centennial Oak of the Polish Physical Society was officially planted in the courtyard of the Faculty of Physics, Astronomy and Applied Computer Science of the Jagiellonian University.

The organizational and financial help from our sponsors was of particular importance. First, we should acknowledge our institutional organizers: Faculty of Physics, Astronomy and Applied Computer Science of the Jagiellonian University, Faculty of Physics and Applied Computer Science of the AGH University of Science and Technology, Institute of Nuclear Physics of the Polish Academy of Science, Faculty of Exact and Natural Sciences of the Pedagogical University in Kraków, Faculty of Physics, Mathematics, and Computer Science of the Kraków University of Technology, and Faculty of Mathematics, Physics, and Chemistry of the Silesian University in Katowice. The financial support was also provided by the Minister of Science and Higher Education (through grant No. 933/P-DUN/2019), the President of the City of Kraków, and MARR S.A. (Małopolska Agencja Rozwoju Regionalnego S.A.). All of them have contributed to the success of the Congress. Thanks to you all.

Photos from the conference, selected recorded lectures, and the concerts are available on the conference webpage under the tab *Po Zjeździe*; see:

<http://www.45zfp.uj.edu.pl>

Also, the concert at the intersection of two infinities is available on YouTube both in Polish and English versions:

<https://youtu.be/OZIIvQgFhgs>; <https://youtu.be/f20Be31NQSw> respectively. A graphical illustration of the Congress selected statistical data are also enclosed below.

We thank the members of the Organizing and Program Committees for their help. In particular, we thank Prof. Roman Płaneta for the logistic help and Profs. Adam Maj and Piotr Zieliński for organizing the concerts. The help in organizing the AGH Day from Profs. Zbigniew Kąkol and Zdzisław Burda is also appreciated. Finally, last but not least, we would like to cordially thank all the Congress participants for creating a good atmosphere and contributing to its scientific success. The advice and help of Prof. Michał Prasałowicz, the Chief Editor of *Acta Physica Polonica B* is gratefully acknowledged.

See you in Warszawa at the Special Centennial Congress in the fall of 2020.

On behalf of Organizing, Program and Publication Committees:

Józef Spalek

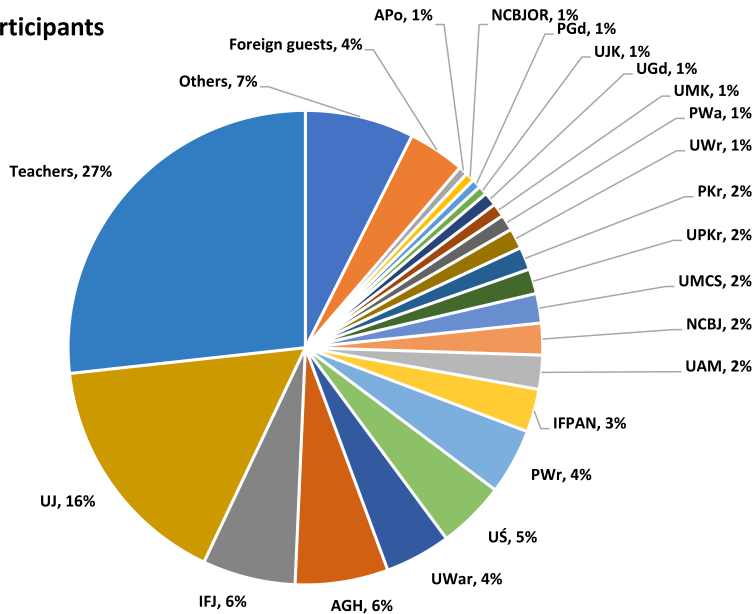
Roman Skibiński

Danuta Goc-Jaęło

Marcin Zieliński

Kraków, June 2020

Congress participants



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| APo | Akademia Pomorska w Słupsku |
| NCBJOR | Narodowe Centrum Badań Jądrowych, Ośrodek Radioizotopów POLATOM |
| PGd | Politechnika Gdańska |
| UJK | Uniwersytet Jana Kochanowskiego, Kielce |
| UGd | Uniwersytet Gdański |
| UMK | Uniwersytet Mikołaja Kopernika, Toruń |
| PWa | Politechnika Warszawska |
| UWr | Uniwersytet Wrocławski |
| PKr | Politechnika Krakowska |
| UPKr | Uniwersytet Pedagogiczny w Krakowie |
| UMCS | Uniwersytet Marii Curie-Skłodowskiej w Lublinie |
| NCBJ | Narodowe Centrum Badań Jądrowych |
| UAM | Uniwersytet Adama Mickiewicza, Poznań |
| IFPAN | Instytut Fizyki Polskiej Akademii Nauk, Warszawa |
| PWr | Politechnika Wrocławska |
| UŚ | Uniwersytet Śląski |
| UWar | Uniwersytet Warszawski |
| AGH | Akademia Górniczo – Hutnicza w Krakowie |
| IFJ | Instytut Fizyki Jądrowej PAN, Kraków |
| UJ | Uniwersytet Jagielloński, Kraków |

Congress Organizers



Polish Physical Society



Kraków Branch
of the Polish Physical Society



UNIwersytet
JAGIELLOŃSKI
W KRAKOWIE

Faculty of Physics, Astronomy and Applied
Computer Science, Jagiellonian University



AGH

Faculty of Physics and Computer Science,
AGH University of Science and Technology



The Henryk Niewodniczański Institute of
Nuclear Physics Polish Academy of Sciences



Faculty of Exact and Natural Sciences,
Pedagogical University of Kraków



Faculty of Materials Engineering and Physics,
Cracow University of Technology



Faculty of Science and Technology,
University of Silesia in Katowice

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i Szkolnictwa Wyższego



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The face (top) and reverse (bottom) sides of the Memorial Centennial Medal of the Polish Physical Society, awarded at the Congress for the community service to the Society.





The Local Organizers and Staff of the 45th Congress of Polish Physicists, Kraków, September 13–18, 2019.

The original photos are available on the webpage:
<http://www.45zfp.uj.edu.pl/#/po-zjezdzie/galeria>