Editorial

Science often develops most vigorously through challenging studies of extreme phenomena. Superheavy elements fall into such a category.

What is the heaviest element that can exist in Nature?

Driven by the continued search for an anticipated "island of stability" of superheavy atomic nuclei and the understanding of their underlying nuclear (in)stability and atomic structure hence chemical properties, the past decades have seen a tremendous progress in experimental ingenuity and theoretical methodology to study and characterize superheavy elements. Therefore, we are very grateful that the Nobel Foundation [1] approved and, jointly with the Knut and Alice Wallenberg Foundation [2], provided the financial resources to organize and conduct the Nobel Symposium NS160, entitled *Chemistry and Physics of Heavy and Superheavy Elements*. These symposia "are devoted to areas of science where breakthroughs are occurring or deal with other topics of primary cultural or social significance" [1]. About three symposia are held each year, roughly every fourth symposium promotes a topic in physics as primary research area, and from about every third symposium a contemporary Nobel Price is being awarded.

In fact, forty-two years ago in 1974, the first Nobel Symposium NS27 in the field of superheavy elements was organized by late Sven Gösta Nilsson [4]. One Nobel Laureate, Glenn T. Seaborg, attended the symposium, together with Aage Bohr and Ben Mottelson, who received the price one year later in 1975. Bridging from past to present, four at the time young researchers brought four decades of theoretical (Peter Möller, Ingemar Ragnarsson, Adam Sobiczewski) and experimental (Peter Armbruster) superheavy element experience to the Nobel Symposium NS160. Furthermore, pioneering work at heavy-ion accelerators has led to the discovery of thirteen new elements in the meantime, starting with element 106, seaborgium, to element 118, oganesson.

Upon arrival in Lund, Sweden, participants gathered at "Biskopshuset" for a presentation of Lund University by the former vice chancellor, Göran Bexell. The reception was hosted by the Science Faculty and the Technical Faculty of Lund University. Thereafter, the Nobel Symposium NS160 continued at beautiful and sunny Bäckaskog Castle near Kristianstad, Scania, Sweden, between May 29th and June 3rd, 2016 [3]. Fifty-one invited scientists provided forty-one presentations, which were sometimes bold, eventually brave, possibly of intriguing simplicity, and at best included all such aspects providing a lively atmosphere. Thirty-six contributions are summarized in this volume.

Following the session on discovery aspects in the morning of Wednesday, June 1st, a brief press conference was held for public outreach. There, any interference was carefully avoided with the announcement of naming propositions for elements 113, 115, 117, and 118, which happened one week later by officials of the International Union for Pure and Applied Chemistry (IUPAC).

There might be the perception that nuclear and atomic spectroscopy, one-atom-at-a-time chemistry experiments, or nuclear reaction studies, simply follow in the wake of new-element discoveries. In turn, many contributions show that with the present end of the

^{48}Ca-beam era, increased theoretical understanding based on more profound and comprehensive experimental data on all of the above is pivotal of any targeted hunt for even heavier elements and/or for reaching the "island of stability". New computational tools and capabilities accompany these theoretical and experimental efforts. Ever increasing sensitivity is being called for, based on continued high-technology R&D on heavy-ion accelerator components, target production, separation techniques, and sophisticated radiation detectors – not to speak of revised or new identification schemes for the predicted shorter-lived (go North for the glory of new elements!) and longer-lived (go East to find the island!) species.

Finally, and to possibly add a grain of salt, on the last transparency of the last presentation of the symposium, Witold Nazarewicz mentioned the importance and incentives of basic science. Indeed, "WOW"-effects define the major driving force of young scientists to reach breakthrough of one or another kind. Undoubtedly, superheavy-element research will continue to allow for numerous "WOW"-effects. Nevertheless, long-term scientific credibility and reputation form another viable basis for sustainability, resources, opportunities, and hence success – opposed to eventually rushed short-term glorification, especially when sought for solely on behalf of the scientists signed responsible for the discoveries.

Anyhow, let's go for the "WOW"! The many young scientists having attended the Nobel Symposium NS160 should be encouraged and able to reach the "island of stability" in the course of the coming decades, i.e. they may celebrate their achievements at the next Nobel Symposium devoted to superheavy element research in the middle of the century.

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References

[1] `https://www.nobelprize.org/nobel_organizations/nobelfoundation/symposia/`.
[2] `https://www.wallenberg.com/Kaw/en`.
[3] `http://www.nuclear.lu.se/ns160/`.
[4] Proceedings of the Nobel Symposium NS27, *Super-Heavy Elements – Theoretical Predictions and Experimental Generation*, eds. Sven Gösta Nilsson and Nils Robert Nilsson, Physica Scripta Volume **10A** (1974).