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The benefits of Nobel Prizes

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The benefits of Nobel Prizes

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There is an urgent need to rethink the Nobel Prize in Physics in the light of the climate crisis. As expressed by its founder, the award should acknowledge research that addresses pressing challenges for humanity.

Every year at the beginning of October, thousands of physicists turn their attention to Stockholm in great anticipation: who will be awarded the highest prize in physics this year? No other prize attracts anywhere near as much attention as the Nobel Prize — for good reasons. A Nobel Prize can secure the reputation of a research field, give it a boost and shape future research priorities. Nobel Prize laureates serve as role models for students and scientists. They have an impact on the next generation of physicists and particularly on the subfields they choose to study or do research in. Nobel Prizes also facilitate the acquisition of national and international research funds in the discipline of the Nobel laureate, and affect the distribution of research budgets within institutes.

After 121 years of Nobel Prizes, it is worth reflecting on their beginnings. As written in the will of Alfred Nobel³, the prizes are to be awarded to those "who, during the preceding year, have conferred the greatest benefit to humankind." Since the first Intergovernmental Panel on Climate Change report in 1990, we have known that we are heading towards a climate catastrophe that could make our planet uninhabitable for humankind. In this context, has relevance to the benefit of humanity actually been sufficiently considered when Nobel Prizes were awarded in recent years or even decades? Do we perhaps need to reexamine the significance of "the greatest benefit to humankind"?

Nobel himself made no comment on what prompted him to set up the fund, the interest from which is annually distributed as Nobel Prize money. There is speculation that his correspondence with the Austrian pacifist Bertha von Sutter, and his knowledge of the occasional devastating effects of dynamite — Nobel's inventing and subsequently patenting of the explosive made him an extremely wealthy industrialist — influenced the criteria for awarding the Nobel Prize. As to the overriding criterion that those who contributed "the greatest benefit to humankind" should be awarded, Nobel expected this to be achieved in physics through the "most important discovery or invention in the field of physics." Many fundamental advances in our understanding of the laws of physics and the Universe

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have been awarded Nobel Prizes⁴. Many achievements which have been awarded a Nobel Prize are fascinating, and beyond doubt worthy of proper recognition. However, we are of the opinion that Nobel's overriding award criterion has often been overlooked.

In terms of benefits, Nobel was thinking in a very contemporary manner. He wanted the "most important discovery or invention ... during the preceding year" to be honored. Therefore, by awarding the Nobel Prize, it would be possible to respond swiftly to contemporary challenges. Therefore, we speculate that Nobel was not primarily interested in conceptual scientific breakthroughs, but in contributions to solving matters relevant for the benefit of humankind.

Currently, we find ourselves in a situation that threatens to make the Earth uninhabitable for us humans. The increase in prosperity and well-being in many parts of the world in recent decades was — and still is — based on the massive combustion of fossil raw materials: oil, gas, and coal. Their combustion is accompanied by an increase in the average global temperature. When fossil raw materials are burned, hydrocarbon compounds are broken up. The carbon atoms combine with the abundant oxygen in the atmosphere to form CO₂, which absorbs infrared light emitted from the Earth's surface, and is thereby transformed into an excited state. When it reverts to its ground state, the CO₂ molecule releases thermal radiation, some of which is re-radiated back to the earth, thus warming the Earth's surface.

Other so-called greenhouse gases with the same effect include water vapor, methane, ozone and nitrous oxide. The greenhouse gases differ in their concentration in the atmosphere and in the frequency ranges in which they absorb photons. Although methane is being released at a much lower rate than CO₂, its effect is even more threatening. On a 20-year time scale, methane warms the earth 72 times and nitrous oxide even 289 times more powerfully than CO₂⁵. Greenhouse gas concentrations in the Earth's atmosphere are still increasing almost exponentially despite all warnings. There is no sign of a flattening of the so-called Keeling curve (Fig. 1). The consequences of human-induced climate change can be felt worldwide in the form of heat waves, flooding, the death of coral reefs, rising sea levels and melting glaciers. If the concentration of greenhouse gases in the atmosphere continues to rise, our planet could indeed become uninhabitable for us.

Can we ignore this as scientists? If not, the question arises whether this crisis should also be reflected in the awarding of Nobel Prizes. Indeed, progress in the development of solar cells was indirectly recognized with the 2000 Nobel Prize in Physics for the development of semiconductor heterostructures⁶. The 2014 award was "for the invention of efficient blue light-emitting diodes, which has enabled bright and energy-saving white light sources"⁷. Climate modeling formed one aspect of

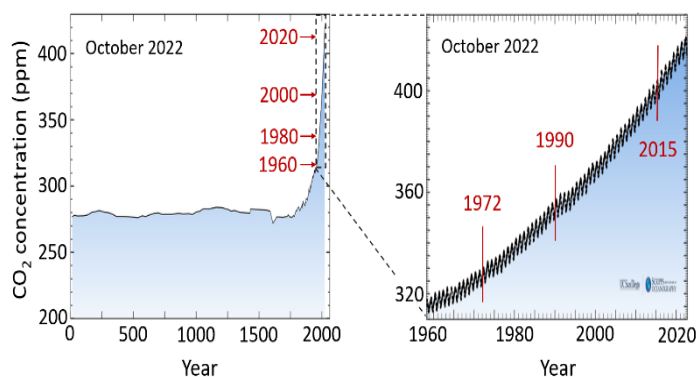


Fig. 1: Increase of CO₂ concentration in atmosphere during the last 2000 years. The left panel shows the CO₂ concentration in the Earth's atmosphere in parts per million (ppm), highlighting the approximately exponential increase over the past decades. The right panel focuses on the evolution since 1960. The marked years correspond to: 1972: Club of Rome: „The Limits to Growth“. 1990: 1st IPCC report, 2015: Paris agreement. 2020 was the hottest year in Europe with (+ 2.63±0.12) °C compared to the preindustrial period (1850-1900)¹. Adapted from: <https://keelingcurve.ucsd.edu/>².

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the 2021 Nobel Prize⁴. Aren't these the kind of advances currently bringing the greatest benefits to humankind? Discoveries and inventions in the field of renewable energy systems in particular offer the chance to curb human-induced climate change. The Nobel Prize Committee should set an example here and once again use Nobel's most important award criterion.

In the past, the Nobel Prizes in Physics were often recognizing advances in knowledge or technology. Today, it should also be about keeping the Earth alive and fertile. Inventions that directly contribute to combat the climate crisis cover a wide range of physics fields. Moreover, crucial progress in technology and material science for solving the crisis rely on work in physics underpinning green technologies. Research areas or inventions include photovoltaics, next-generation batteries, the physics behind networks and power delivery systems, wind turbine design, and liquid crystals enabling low-energy displays. In our view, these are the type of topics that are of the highest relevance right now — here lie the discoveries that will help sustain human life on Earth.

The awarding of a Nobel Prize is an endorsement of the subject matter with a big impact on science politics. This means that the Nobel Prize Committee can influence research at universities and research institutions. But it is not only the Nobel Prize Committee that is called upon. We as scientists should constantly remind ourselves of our responsibility. We must undertake excellent research that will benefit humankind. But we also urgently need clear communication of the facts. As much as we have talked about the climate so far, so little of it seems to have reached physically measurable reality. The 6th Intergovernmental Panel on Climate Change report showed us that even limiting global warming to 2°C seems barely achievable⁸. It is therefore even more important that we live up to our responsibility to society and point out the consequences of the climate crisis.

As scientists, we can clearly distinguish between laws and natural laws. We know what tipping points, exponential effects and chain reactions are. We believe it is the duty of the community of scientists to communicate this to the general public. That means being responsible. Not to do so would be escapism. "Those who have the privilege of knowing have the duty to act" is a famous quote attributed to Albert Einstein.

Regarding the climate crisis, there is an established scientific consensus. And this must resound from a wide and diverse range of voices, from all of us, everywhere, in private and in public. Only then will the public have a chance to truly understand the consensus. This also means tackling misinformation much more assertively. We need to explain that non-negotiable principles of nature demand behavioural changes from us right now. Therefore, we believe it is essential that the significance of the climate crisis and the most important breakthroughs in physics relevant to it be brought to public attention — including the Nobel Prize in Physics. Because contributions to the mitigation of the climate crisis will offer the greatest benefit to humankind.

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Competing interests

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