

THE  KAVLI PRIZE

KAVLI PRIZE IN
NANOSCIENCE 2020

*The Norwegian Academy of Science and Letters has decided to award
the Kavli Prize in Nanoscience for 2020 to*

HARALD ROSE

Universität Ulm, Germany

MAXIMILIAN HAIDER

CEOS GmbH, Germany

KNUT URBAN

Forschungszentrum Jülich, Germany

ONDREJ L. KRIVANEK

Nion Co., US

“for sub-ångström resolution imaging and chemical analysis using electron beams”

Seeing leads to scientific advancement, understanding and engineering. The 2020 Kavli Prize in Nanoscience honours four pioneers who enabled humanity to see the structure and chemical composition of materials in three dimensions on unprecedentedly short length scales.

A major goal of nanoscience is to create materials and devices assembled with atomic scale precision to obtain novel functionalities. The size of an atom is around one ångström (0.1 nanometer). Therefore, imaging and analysis of materials and devices at the sub-ångström scale is crucial. The resolution of a classical microscope is limited by the wavelength of the probe used for imaging. Because visible light has a wavelength around 5000 times larger than an atom, optical lenses cannot image atoms. In the early part of the 20th century beams of electrons with atomic scale wavelength became available, leading to the

invention of the electron microscope in 1931. However, making ideal lenses for electrons turns out to be a big theoretical and experimental problem because lens aberrations limit the resolution. For more than 60 years people struggled! Through persistence, ingenuity and exploitation of the increase in computational power in the 1990s the Laureates constructed aberration corrected lenses and made sub-ångström imaging and chemical analysis in three dimensions a standard characterization method.

Three of the Laureates co-founded two companies and commercialized their lenses contributing further to the major impact of their scientific work. Since then their microscopes have played an enormous role both in fundamental science and technology, where they are used, among others, by semiconductor, chemical and automotive industries.

The 2020 Kavli Prize Laureates in Nanoscience are

Harald Rose, for proposing a novel lens design, the Rose corrector, enabling aberration correction in transmission electron microscopy that can be applied to both conventional and scanning microscopes.

Maximilian Haider, for the realization of the first sextupole corrector, based on Rose's design, and for his role in the implementation of the first aberration corrected conventional transmission electron microscope.

Knut Urban, for his role in the implementation of the first aberration corrected conventional transmission electron microscope.

Ondrej L. Krivanek, for the realization of the first aberration corrected scanning transmission electron microscope with sub-ångström resolution, well suited for spatially resolved chemical analysis. This

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Science and Letters**

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See also:

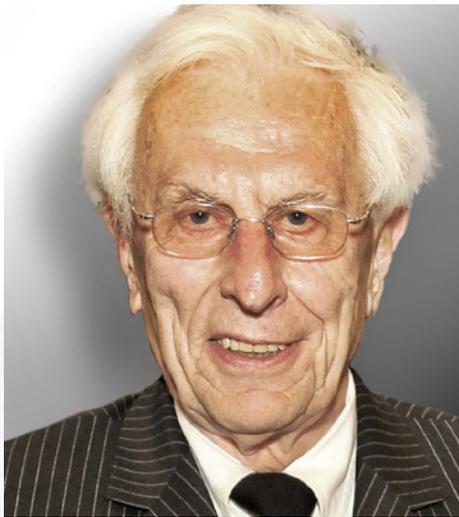
The Kavli Prize

www.kavliprize.org

The Kavli Foundation

www.kavlifoundation.org

was obtained using a quadrupole-octupole
corrector.



Harald Rose
Universität Ulm, Germany
Photo: © private



Maximilian Haider
CEOS GmbH, Germany
Photo: © "Bilderfest" Germany



Knut Urban
Forschungszentrum Jülich, Germany
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Ondrej L. Krivanek
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