



The untiring conversation

Copenhagen

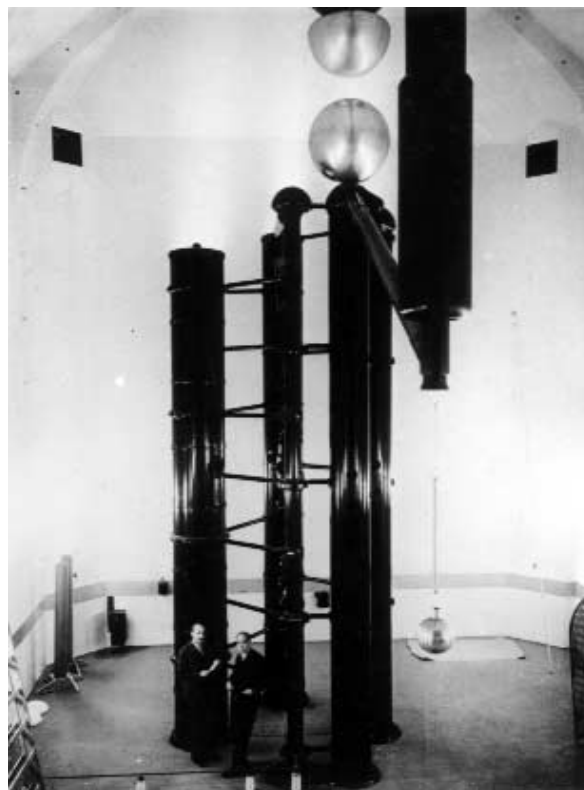
Der Kopenhagener Geist—“the Copenhagen Spirit,” an expression minted by Werner Heisenberg, originally referred to a certain way of tackling the problems of theoretical physics. The term later came to mean a way of working in general and the atmosphere that prevailed in the circle surrounding Niels Bohr.

Certain people seem to have the capacity to encourage ideas not only in themselves, but in others. Niels Bohr was one of those people. In the 1920s and '30s, numerous physicists, chemists, and biologists were drawn to Copenhagen in order to speak with Bohr and to experience the milieu in which he lived and worked.

Niels Bohr came from a family with a strong academic background. His father Christian Bohr was an internationally renowned scientist, and his brother Harald was an accomplished mathematician. Thanks to the atomic model that he presented in 1913, the name of Niels Bohr had become a household word in theoretical physics. His family traditions certainly helped his academic self-assurance. After having lost a competition for a professorship, he managed to establish a special chair in theoretical physics for himself at the University of Copenhagen. In 1918 he convinced the Danish parliament to finance the building of an entire institute for theoretical physics.

Many of the founders of the new physics sought out Bohr and his institute: Werner Heisenberg, Erwin Schrödinger, Paul Dirac, Wolfgang Pauli, Max Born, and many others. These scientists came from many different parts of Europe, but Copenhagen and Niels Bohr became

< Bohr engaged in intense discussion with colleagues Wolfgang Pauli, Lothar Wolfgang Nordheim, Erwin Fues and Leon Rosenfeld in 1929.



Niels Bohr and George de Hevesy at the Van de Graaf generator.

their meeting point. Bohr had a documented talent for seeing people's gifts and for finding and supporting promising young researchers. All who became involved in this process of discovery visited the brick building on Blegdamsvej Street at one point or another. All of them were infected with the feeling that they had participated



Niels Bohr arriving at his institute by bicycle.



Niels Bohr, James Franck, and Hans Marius Hansen in 1921.



Bohr's institute became a destination for physicists from all over the world, among them Japanese Yoshio Nishina and Indian Bidhi Busan Ray.

Hans Marius Hansen, Niels Bohr, and Paul Ehrenfest in the institute library.

in something great, and that they had had a hand in creating something new.

Bohr was far from a brilliant lecturer. Instead, he constantly needed to converse with other physicists. In these conversations, he tried to determine partly his own thoughts and partly the thoughts that his conversation partners had. Stories are told of how he could wander around hour after hour with his pipe, mumbling as he tried to clarify and purify the basic characteristics of a problem. The more important were the things he had to say, the more he mumbled and fiddled with his pipe.

Niels Bohr and Albert Einstein could immerse themselves completely in conversation and forget time and space in their most practical, concrete sense. One anecdote tells that during a visit Einstein made to Copenhagen, they took a streetcar to Bohr's institute. However, they became so involved in conversation that they forgot to get off when they reached their stop. Several stops later, they got off and took the streetcar back, but became lost in conversation again, and rode too far in the other direction. The procedure was repeated several times before they finally remembered to get off at the correct stop.

These conversations were not limited to the Institute, but continued at Bohr's summer home in Tisvilde, north of Copenhagen, on long walks or on boat trips. The atmosphere was an intimate one in which Bohr's entire family participated.

The atmosphere at the institute was unusually informal for the time. Otto Robert Frisch related that when he arrived for a seminar, he was greeted by the sight of Lev Landau lying on his back on a table, deep in discussion. Bohr did not seem to see anything odd about this. It took time to become accustomed to the habits of the institute, where nothing else mattered except the ability to think clearly.

Discussions with Bohr could also be taxing. Heisenberg told of one episode in which Erwin Schrödinger's health was put at risk. In 1926 while in Munich, Heisenberg and Schrödinger happened into a conversation on the interpretation of wave mechanics, which revealed that their opinions were diametrically opposed. Heisenberg later wrote to Bohr, who invited both him and Schrödinger to Copenhagen. The discussions between Bohr and Schrödinger began at the train station and continued



Bohr at the blackboard.

uninterrupted. The usually amiable Bohr could at times become fanatical and unconciliatory—which happened at that time. He was not prepared to accommodate his opponent in the least, and refused to tolerate the minutest lack of clarity. The discussions continued day and night without either party reaching agreement on any point.

Schrödinger was staying with Bohr and his family, and thus found little respite. He became sick from overexertion and took to his bed with a fever. Mrs. Margrethe Bohr nursed him and served him tea and cookies. Niels Bohr, however, sat on the edge of Schrödinger's bed, verbally attacking him: "But surely you must realize that..."

Heisenberg himself lived for several years in the Institute's attic apartment, with a view over Copenhagen's Fælled Park. The Bohr family's villa was located in the same neighborhood. Bohr would often visit Heisenberg for nighttime discussions that would last until both of them were weary. Yet these discussions also helped Bohr develop his theory of complementarity, and Heisenberg to develop his theory of uncertainty.

Despite the strains, Niels Bohr created an intellectual oasis for his many visitors, which even became a sanctu-



For several years physicists traveled to Copenhagen to attend conferences arranged by Niels Bohr. Above, Wolfgang Pauli, Werner Heisenberg, and Niels Bohr can be seen at the center of a picture from a conference in 1936. Below, the three are involved in a discussion at the same conference.



ary during times of world strife. After WWI, Copenhagen was untouched by the battles and political uneasiness that plagued much of the rest of Europe, especially Germany, where quantum mechanics had its birthplace in Munich and Göttingen. Later in the 1930s, many of Bohr's friends fled the Nazis and the war and found refuge in Copenhagen. Some stayed, but most of them traveled on to England or the United States with Bohr's help. In 1943, Bohr himself was forced to flee, and did not return until after the end of the war.

In establishing new research institutes, many have sought to recapture the creative atmosphere that surrounded Niels Bohr. Max Delbrück, who had spent time in Copenhagen during the 1930s, was one of them. He tried to create something similar at the California Institute of Technology and even during his summers at Cold Spring Harbor. There, James Watson was also influenced. Delbrück also passed on the ideal to Niels Jerne and Fritz Melchers, who tried to encourage this attitude toward research at the Basel Institute for Immunology.