markable advances in the ability to control and cool atoms in the gas phase. Those advances have been enabled by laser-cooling, which produces ultracold atomic gases. The atoms are then further cooled by evaporation to create quantum degenerate gases. However, those methods are far from ideal, even for atoms.

Laser cooling is not a general method. Due to the requirements of a cycling transition and available lasers, it works on only a small set of elements in the periodic table. Evaporative cooling requires the right balance between elastic and inelastic collisions, again severely limiting generality. Furthermore, evaporative cooling leads to a large loss of atoms. For the alkalis, the optimum cases for laser cooling and evaporative cooling, the flux of ultracold atoms has been limited by optical density to around 10^9 atoms per second.

It is natural to ask whether one can invent new methods that work on most elements and that break the current limit on flux. Such a development would open many new possibilities for fundamental science and for real-life applications. The challenges and limitations have motivated several groups to explore alternative approaches. One method is buffer-gas cooling, pioneered by John Doyle at Harvard University.[1] A different approach was developed independently and in parallel by Frédéric Merkt and his group at ETH Zürich and by my group at the University of Texas at Austin: magnetic stopping and trapping of paramagnetic atoms in a supersonic beam.[2,3] That work was summarized in an invited review article I wrote for *Science*.[4] Since then, many new developments have continued to advance the field.

Now that the first sentence of the Search and Discovery piece is out of the way, I can discuss the rest—in particular, the motivation of studying quantum chemistry and the question of whether one actually needs to trap molecules. The goal of studying chemical reactions at ultralow temperatures is to observe unique quantum pathways that can dominate the reaction dynamics. Until recently it has been an elusive goal. Stopping and trapping molecules, either by electrostatic or magnetic forces, has produced a phase-space density that is too low for the study of chemical reactions. Molecules at much higher phase-space density can be produced by starting with Bose–Einstein condensates and "making" molecules with lasers. However, those experiments have so far been limited to alkali chemistry.

Work by the Narevicius group at the Weizmann Institute of Science in Israel provided a major breakthrough in quantum chemistry without the need for stopping and trapping. Their approach relies on the merging of two supersonic beams by magnetically deflecting one of them.[5] The copropagating beams have controllable collision energies down to temperatures of several millikelvin. The resulting chemical reactions, observed as a function of energy, reveal striking quantum resonances in the reaction dynamics. That work is continuing, and it demonstrates the power of merged beams, which do not require trapping and cooling. To study slower chemical reactions, trapping at high phase-space density is necessary. New ideas and work along those lines are in progress and will hopefully prove successful.

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Heisenberg letters show courage in horrific times

Silvan Schweber's review of *My Dear Li: Correspondence 1937–1946* (PHYSICS TODAY, July 2017, page 59) by Werner Heisenberg and Elisabeth Heisenberg is a poignant commentary—sadly, at the end of his life. It is poignant because it bespeaks the impossibility of reconciling any life lived in freedom of expression and governed by law with the one Werner Heisenberg chose in Germany, against the odds, despite being deprived of such liberty. Is it the right moral choice to continue living in one's country under repressive circumstances? What considerations play into such a decision?

The correspondence in the book

sheds a direct light on such questions and the consequences of the answers. When individual needs yield to responsibility writ large, there is much to be admired, even when it does not line up with unambiguous heroism. The luxury of 20/20 hindsight, now that we know the full extent of the Holocaust and, yes, the first two atomic bombs, makes us contemporaries shudder.

While I was translating my parents-in-law's letters, I was acutely conscious that certain passages in them would raise eyebrows for many with different life experiences. False dichotomies so easily arise. I understand historic judgment and its merit in establishing valuable markers for future generations. Yet I also think that the bulk of the correspondence is persuasive as an example of courage and honor during horrific times.

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I read with interest Silvan Schweber's review of *My Dear Li: Correspondence 1937–1946* by Werner Heisenberg and Elisabeth Heisenberg, and I noted with sadness Schweber's passing on 14 May 2017.

I knew Werner Heisenberg quite well, having worked in the Max Planck Institute for Physics under his directorship for two decades, beginning in 1950. I had the opportunity to talk with him about his work during the war. I also frequently met Elisabeth Heisenberg at various events.

Schweber captures well the feelings and thoughts Heisenberg expressed in letters to his wife from 1937 to September 1939. Schweber's comments on the later letters, however, need some clarifications.

Working on the German atomic bomb was not Heisenberg's decision. He was drafted in September 1939 to serve with other leading scientists in a group later known as the Uranium Club. Heisenberg was tasked with finding out whether the energy released by nuclear fission could be used for military and civilian purposes. After extensive studies he decided that applications of that type would be possible theoretically but that practical implementation of them would require a huge and lengthy industrial effort.[1]

As a result, Minister of Armaments Albert Speer terminated the bomb project in 1942 and concentrated all available resources on weapons production. Nevertheless, the German Army Ordnance Office continued military uranium research with its own small group, with which Heisenberg was not involved. He continued to focus on cosmic rays, S-matrix theory, and construction of a small test reactor.

It is true, as Schweber suggested, that Heisenberg identified with his beloved Germany, but he did not identify with the Nazi ideology. He did not join the Nazi Party, and he had many Jewish friends and pupils and maintained friendly relations with his Jewish colleagues. He probably felt a certain admiration for the rapid advances of the German armies in 1939–41. Like many non-Nazi Germans at the time, he did not want Hitler to win the war, but he did not want Germany to lose it.

Schweber takes exception to Heisenberg's statement to his wife, made after his visit with Niels Bohr, that he had "his assigned part . . . to defend our system." But what else could Heisenberg have done when, unavoidably, the circumstances of German occupation of Denmark came up in conversations? He had to assume that his words and actions were carefully observed by the Gestapo. He also had to expect that Bohr might unwittingly disclose what he had said. Any remark showing opposition to or even dissatisfaction with the Nazi system might have had severe consequences.

Heisenberg also had to face the question of whether to leave Germany in 1933 after the Nazis took over. Lise Meitner didn't leave until 1938, when her Austrian passport no longer protected her from Nazi persecution; she later said she had "committed a great moral wrong" by not leaving earlier. Schweber believed that the same was true of Heisenberg. Indeed, Heisenberg discussed leaving in 1933 or 1934 with Max Planck, president of the Kaiser Wilhelm Society for the Advancement of Sciences. Planck believed that the scientists who were not forced to leave Germany should stay and try to preserve as much as possible of the nation's culture and former scientific excellence. He compared Nazism to a storm that causes major damage but will pass eventually. All forces would then be needed to rebuild the country, as happened after World War I.

Heisenberg hoped for a similar reconstruction after World War II. However, only he, with his international scientific reputation, attracted foreign students and collaborators. German universities as a whole had lost their pre-1933 excellence because of the expulsion of leading Jewish physicists and Hitler's contempt for modern "Jewish" physics. The center of excellence in physics had moved to the US.

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A universal human constant?

Forty-four years ago, Joseph Keller wrote in "A theory of competitive running" (Physics Today, September 1973, page 43) that "world records for running provide data of physiological significance," since the record times are very close to the ultimate capabilities of the human body. By comparing the relative performances of men and women in multiple sports and various event types and distances, I thought we might find something universal that is independent of the particular physical capabilities and requirements of any sport.

I decided to investigate how the record running times for women and men compare over different distances by looking at the simple measure of the record time for men divided by the record time for women—that is, relative average speed.

For example, for the 200 m dash, Usain Bolt holds the men's outdoor world record of 19.19 s. Florence Griffith-Joyner holds the women's outdoor world record