

The Race for the First Reactor

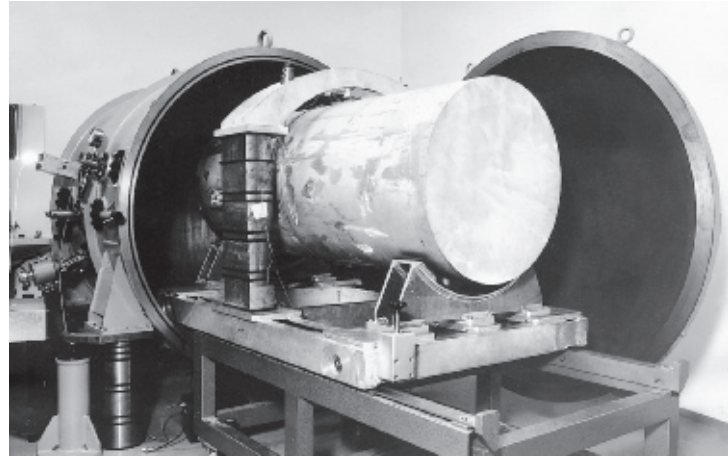
When the Max Planck Institute for Physics relocated to Munich 50 years ago, it found more than just a new home. Following the move from Göttingen – another instance of Werner Heisenberg's deep commitment – the institute also changed its scientific focus. Instead of nuclear fission, the scientists turned their attention to plasma research and nuclear fusion – not least because of the research reactor being built in Karlsruhe for industrial purposes.

At least one thing was clarified by then: "Nuclear physicists not responsible for bad weather" declared the GÖTTINGER TAGEBLATT on September 21, 1954, following a lecture by Rudolf Schulten, a reactor physicist at the Max Planck Institute for Physics. The article went on to explain that an exploding atomic bomb would not ionize the air sufficiently to create areas of high or low pressure. As Schulten explained, it would take about 2,000 exploding bombs to do that. And after such an inferno, mankind would have more to worry about than bad weather – if mankind even still existed.

Nuclear energy, and thus also nuclear physics, have clearly always aroused more or less justified fears. Werner Heisenberg, Nobel laureate and Director at the Max Planck Institute for Physics, nevertheless continued to research nuclear processes for every peaceful purpose. This explains why he was keen to build a research reactor – a delicate subject so soon after the war. Nevertheless, the Germany Treaty of 1955 permitted such a reactor to be built. The question was, where? In a mangled mix of metaphors, the resulting argument was dubbed the Nuclear Cold War.

In the aftermath of the Second World War, the Max Planck Institute for Physics was housed in the former Aerodynamic Experimental Institute (AVA) premises in Göttingen, an arrangement that Heisenberg always viewed as temporary. But the institute was growing so dynamically that its accommodations soon became cramped. However, there was no space available in Göttingen for a bigger building, and even less for a research reactor. The only option was to relocate.

Two cities vied to offer a home for the Max Planck Institute and the nuclear reactor: Karlsruhe and Munich. And both offered Heisenberg's institute the prospect of substantial financial support. The Bavarian Minister of Education and Science at the time, August Rucker, was willing to contribute six million Deutschmarks to build an institute in Munich. Bavaria also offered a workable source of uranium in the form of copper uranium oxide deposits in the Fichtelgebirge mountains. With these arguments, the Bavarian Government hoped to attract the Max Planck Institute for Physics to the banks of the Isar river. Not least among its motives was the



Gravitational waves were also among the targets hunted by scientists at the MPI for Physics in Munich – Heinz Billing tracked them down with an aluminum cylinder, the centerpiece of the Weber experiment.

desire that nuclear energy might free Bavaria from its dependence on coal from the Rhineland, and that the Max Planck Institute might attract an influx of talented students.

But Baden-Württemberg outbid Bavaria with an offer of ten million Deutschmarks. The squabble over the site of the institute went beyond the realms of science and economics. Munich's breweries feared that radioactive effluent might pollute the groundwater, and with it, their beer. It took an expert report to persuade the State Parliament to overturn the objection.

At a "nuclear conference" in June 1955, Chancellor Konrad Adenauer proposed a compromise under which both Bavaria and Baden-Württemberg could claim victory: the Max Planck Institute for Physics would move to Munich with a light water reactor for basic research. Given the city's proximity to the Iron Curtain, he considered it too risky a location for a heavy water reactor for industrial research, which was thus built in Karlsruhe, complete with its own research center.

In October of that year, the Senate of the Max Planck Society resolved to relocate the institute to Munich. It was to settle by the Isar river by 1958. Officially, Heisenberg welcomed the move on the grounds that it would expand the scope for experimentation. However, it also represented the fulfillment of a personal wish. He had felt close ties with the city ever since his younger days and his time as a student. When Munich celebrated its 800th anniversary, he praised its beauties:

"Ludwigsstrasse from the Siegestor to the Feldherrnhalle, bathed in sunlight, the view from the Monopteros looking

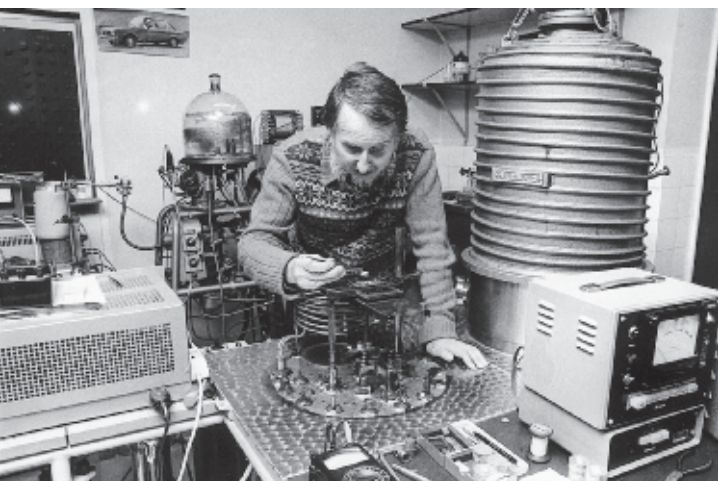
across the flower-strewn lawns of the English Garden to the Frauenkirche, the 'Marriage of Figaro' at the Residenztheater, the Dürer collection at the Pinakothek, the train to Schliersee and Bayrischzell packed with skiers, and the beer tent crowned with the Bavarian lion at the October beer festival."

The Heisenberg family moved to Munich in July 1958. A short time later, he and his colleagues took possession of the new institute premises. In the north of the city, architect Sep Ruf, a school friend of Heisenberg, constructed a new building that was inaugurated on May 9, 1960: Heisenberg remarked at the official opening that they had preferred to delay the ceremony until the institute could be reached without sinking in the mud. Prior to that time, there were no paved roads leading to the site.

Even before the institute and before the reactor in Karlsruhe were ready, Munich's reactor was up and running, though by this time it belonged to the Technical University. Almost parenthetically, Bavaria's Minister President Wilhelm Hoegner had offered it to Heinz Maier-Leibniz, who taught physics at the university. After consulting briefly with his

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The parties had all already agreed on a different solution at the "nuclear conference" chaired by the Chancellor in Bonn on June 29: the first industrial reactor is scheduled for Karlsruhe and the first research reactor for Munich. To restore peace, Adenauer publicly confirmed this decision.



Without new techniques, there would be no new physics: Helmut Lindner prepares a Josephson contact that is particularly sensitive to radio signals from space.

colleagues, Maier-Leibniz accepted – on the condition that it included an institute. Hoegner inaugurated the reactor in 1957. Due to its shape, the reactor dome was soon nicknamed the "Atomei" (atomic egg).

From then on, however the Max Planck physicists in Munich ceased their studies of the processes of nuclear decay. This was reflected in the institute's new name: the Max Planck Institute for Physics and Astrophysics. The initial intention was that its experimental work should focus on plasma physics. The experiments aimed to create the conditions observed in the stars, as Heisenberg commented in his opening address.

Plasma is the name physicists use to describe the fourth state of matter, in addition to solids, liquids and gases. Plas-

mas are ionized gases that are outwardly more or less neutral. On Earth, plasma is found in lightning flashes, or it is created artificially. Since stars and almost the entire interstellar gas are composed of plasma, it is the most common state of matter in the universe. So in order to gain a better understanding of the physics of space, it would be helpful to be able to imitate the temperatures and densities that occur in the atmospheres of stars – that is, to conduct astrophysics in the laboratory, as Ludwig Biermann put it. As Co-Director responsible for astrophysics, he studied the solar wind – which he discovered – that also blows through our planetary system in the form of plasma (see MPR 2/2006).

A better understanding of this state of matter, which on Earth is somewhat exotic, could also lead to a new source of energy for the world, if only the fire of the stars could be ignited here on Earth. In this spirit, the scientists at the Max Planck Institute for Physics turned their attention from splitting the atom to nuclear fusion. Today, this research is continued by a successor institute, the Max Planck Institute for Plasma Physics.

Besides plasma in space and on Earth, from the outset, the staff at the Munich institute has also concerned themselves with elementary particles. Their studies of cosmic radiation while still in Göttingen fell within this field. Using the new "accelerator machines" then being built in Berkeley and Geneva, physicists were able to artificially create the most elementary building blocks of matter.

At the start of 1960s, they set their sights on mesons, among other things. We now know that these unstable particles do not themselves belong to the actual group of elementary particles, since they are composed of several even smaller – elementary – particles. But they do also occur as subunits of the matter of which the Earth is composed. And their decay processes offer some clues as to the properties of their elementary components.

Particles like these, which exist for just tiny fractions of a second, were detected by physicists in the early 1960s almost on a monthly basis – thanks to the accelerators. At CERN in Geneva, for example, scientists from the Max Planck Institute for Physics experimented with protons, the nuclei of hydrogen atoms, which they accelerated to an energy of several billion electron volts. The collisions created particles that leave measurable traces in a bubble chamber – a chamber filled with liquid hydrogen.

Using this technique, in 1963, the physicists in Munich added new species to the particle zoo – at that time primarily mesons that were previously unknown to physicists. Such discoveries were possible only due to the great ingenuity with which the physicists refined their experimental techniques. It also took considerable creativity to master the resulting volumes of data. Since then, the research conducted at the Max Planck Institute for Physics has made great strides, but the scientists must still overcome the same kinds of challenges – for example at the Large Hadron Collider just recently commissioned at CERN.

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