

**Dialogue between Science and Politics:**

# **The Striking Angela Merkel: Physicist, Quantum Chemist and Politician**

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# Dialogue Between Science and Politics: The Striking Angela Merkel: Physicist, Quantum Chemist and Politician

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*Ein Chemiker, der kein Physiker ist, ist gar nichts.  
(A Chemist, who is not also a physicist, is nothing.)  
Robert Wilhelm Bunsen*

## 1. Introduction

....and I would add to Bunsen's Motto, that it does no harm if a politician is also a scientist (and the reverse). This issue of the VSH Bulletin is dedicated to the dialogue between science and politics. Often this dialogue is complicated, because politicians and scientists speak very different languages, and, indeed, scientific literacy is relatively rare among politicians, with some exceptions. Angela Merkel is one such exception, with a strong scientific background, which has motivated her as a politician to cherish the dialogue with science and scientists. I had been asked some time ago to write about her in this context for a French publication<sup>1</sup> and the present contribution is a slightly modified English version of that text, which

<sup>1</sup> M. Quack: Angela Merkel, physicienne, chimiste quanticienne, et chancelière. In: *Étonnante Chimie, découvertes et promesses du XXI<sup>e</sup> siècle*. Claire-Marie Pradier, Francis Teyssandier et Olivier Parisel (Eds.). CNRS editions, Paris 2021, ISBN 978-2-271-13652-7.

thus should be accessible to readers not mastering the French language. I include some general comments, and this seems to fit well as an example and perhaps even role model, how the dialogue between science and politics can be improved, if we have politicians with a scientific background.

In reports on Angela Merkel, she is often introduced as a physicist, which is formally correct given her undergraduate studies in physics. However, already towards the end of her studies she switched to the important interdisciplinary field of physical, theoretical and quantum chemistry, which became also the topic of her research work towards a doctoral thesis, representing usually the most important starting point in an early scientific career. Indeed, when I first got to know Angela Merkel in 1986–1987, she was already what one would call a full-time quantum chemist in the field of quantum chemical kinetics, quite close to my own research interests. There was at the time not the slightest hint – at least not for me – of what would be her later most striking political career, although as an academic teacher I used to tell my students: Good science students can do almost everything in their life, well beyond science.

When I once had to give a lecture to a relatively broad audience of students, in chemistry, science and technology, but also senior colleagues from Chemistry, Physics and other fields and other areas at ETH Zurich, and including also parents of students, friends, relatives and people from the general public, I addressed among other matters the career opportunities for science students. I noted then that even among my personal acquaintances of students and friends, I have seen a great diversity of perfectly international career paths. These include the most obvious careers as researcher in industry, or in private and government research institutions, professors at universities worldwide, teachers at high schools, employees as chemists in production and also salesmen for instrument builders and technical equipment, founders and owners of start-up companies, administrators in public institutions including environmental and public health agencies, advisors to governments, journalists and book writers, managers at various levels including up to CEO of major international companies, and finally political leaders of major countries. There are,

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**Martin Quack**, Dr ès sces techn, studied Chemistry and Chemical Physics in Darmstadt, Grenoble, Göttingen and at the École Polytechnique Fédérale de Lausanne, where he received his doctoral degree in 1975. He was 1976/77 Max Kade Fellow at the University of California Berkeley and habilitated in Göttingen in 1978. He was appointed full professor (C4) at the University of Bonn in 1982 and Professor Ordinarius for Physical Chemistry at ETH Zurich in 1983, where he stayed since then. He was also Hinshelwood lecturer and Christensen Fellow of St. Catherine's College at Oxford University (1988) and visiting Miller Research Professor at the University of California Berkeley (2005). In recognition of his research on molecular kinetics and spectroscopy he received numerous prizes and honours, among which is the Paracelsus Prize of the Swiss Chemical Society, and he holds an honorary doctorate from the University of Göttingen. After mandatory retirement from his teaching and administrative functions at age 65 in the fall of 2013 he continued as Professor Emeritus at ETH with research of his group concentrating on some of the most fundamental problems of molecular primary kinetics, in particular also concerning parity violation and tunnelling in chiral molecules with support from an ERC advanced grant and grants from the SNFNS and ETH Zurich. He has been elected member of several academies, and also as foreign honorary member of the American Academy of Arts and Sciences, and corresponding member of the Göttingen Academy of Sciences and the Academy of Athens, Greece. In 2014 he was elected as member of the presidium of the Leopoldina (re-elected 2019).

Photo: Martin Quack

of course, a few well-known political leaders who started as chemists; Chaim Weizmann, the first president of Israel, originally a chemist and considered to be the father of industrial fermentation, or Margaret Thatcher, who started her career as a chemist, spectroscopist and crystallographer with a master's thesis at Oxford University under Nobel prize winner Dorothy Hodgkin and also supervised there by Gerhard Schmidt, later a director of the Weizmann institute of science. But I did not know these politicians personally, and I rather had in mind Angela Merkel, without identifying her by name at the time (2014), who actually had the most striking career of all those, finally becoming Federal Chancellor of Germany and a major leader in European and World politics, several times voted by journalists as being the most powerful woman of the world.

## 2. The early scientific education and career of Angela Merkel

Here I shall briefly outline this astonishing career as far as the early scientific part is concerned, of which usually not much is told when reporting about her life. Angela Merkel was born in Hamburg, West Germany in 1954, but her father as a protestant minister moved to the eastern part of Germany, the "DDR" under Soviet domination at a time, when relatively free movement between the parts of the divided Germany was still possible, and when the eastern areas had an urgent need for personnel in the churches.

Finishing as an excellent high school student, Angela Merkel chose to study physics at the University of Leipzig. She received her diploma (Dipl. Phys.) in physics there in 1978 with also some research in theoretical chemical kinetics, represented in her first scientific publications. From there she moved in that year 1978 to the "Zentralinstitut für Physikalische Chemie" at the Academy of Sciences in East Berlin to work in quantum chemistry until 1990. With this move towards an interdisciplinary field between Physics and Chemistry she showed excellent scientific taste as just about at that time an era started that some have called the "third age of quantum chemistry": For the first time fundamental "ab-initio quantum chemistry" was becoming able to provide quantitatively accurate results for "real", if still simple, molecular systems also of practical importance, say, in atmospheric chemistry, combustion, and environmental science and related areas. For her thesis work, Angela Merkel chose as mentor Lutz Zülicke, a respected quantum chemist at the academy of sciences of the "German Democratic Republic (GDR)" in Berlin Adlershof and also a textbook author. She completed her thesis on investigations of the mechanism of simple bond fission reactions and the compu-

tation of their rate constants on the basis of quantum chemical and statistical methods in 1986, being promoted then to Dr.rer.nat.<sup>2</sup>

It is from that time, when I became aware of her notable scientific work. One of her several significant publications resulting from the thesis research was submitted in 1986 to the international journal "*Molecular Physics*", where I was the one of the editors handling that publication. Her earlier papers on that general topic had been published in the "*Zeitschrift für Physikalische Chemie (Leipzig)*" in Eastern Germany. The submitting author was her mentor Lutz Zülicke, whom I had known for a number of years already, as he was one of those scientists from the GDR who were allowed to travel to Western Countries. I think that I had met him first at a meeting in Bielefeld, in 1980, but he also later visited Switzerland. Knowing his scientific style, I immediately realised, that there was really a brilliant young doctoral student behind this work, the first author Angela Merkel.<sup>3</sup>

I remember this manuscript particularly well, out of many which I handled as editor for *Molecular Physics*, as it had a close relation to my own thesis work a decade earlier with Jürgen Troe at the Ecole Polytechnique Fédérale de Lausanne (EPFL), where I had until 1975 developed the statistical adiabatic channel model (SACM) for unimolecular bond fission and bimolecular complex forming reactions. At that time the term "model" was chosen on purpose by me instead of theory, because carrying out the calculations on a number of relevant reactions was only possible by means of a semi-empirical theory including model parameters derived from experiment. Even such computations counting all quantized reaction channels were at the limit of the computer power then available. When Angela Merkel entered that field she had a most timely idea by realizing that by the time of her thesis it was possible to transform that simple model into an "ab initio theory" by means of accurate quantum chemical calculations allowing her to make a most significant contribution to the field. Indeed, her thesis contains a number of outstanding results along these lines, which I will not discuss in detail here. However, I should mention that also with her choice of applications of her theory to molecular systems she showed superb taste: One of her main investigations

<sup>2</sup> Angela Merkel: Untersuchung des Mechanismus von Zerfallsreaktionen mit einfachem Bindungsbruch und Berechnung ihrer Geschwindigkeitskonstanten auf der Grundlage quantenchemischer und statistischer Methoden. (Doctoral dissertation carried out at the academy of sciences of the GDR, 1986)

<sup>3</sup> A. Merkel and L. Zülicke: Nonempirical parameter estimate for the statistical adiabatic theory of unimolecular fragmentation. *Mol. Phys.* 60 (1987) 1379–1393.

concerned the dissociation of the methyl radical  $\text{CH}_3$  into methylene  $\text{HCH}$  and  $\text{H}$  atoms, a pioneering study for this reaction. The methyl radical is a central species in chemistry and chemical kinetics. For instance, the discovery and interpretation of its spectrum earlier in 1956 had led among other things to the Nobel Prize in chemistry for Gerhard Herzberg in 1971.

The summary record of the handling of the publication of that paper is still available in my files for MP.xx.1986. It had the typical fate of a good manuscript. Receiving a positive assessment requesting, however, some revisions of the originally submitted version, the revised version was finally accepted on 12 November 1986 and published smoothly in 1987.<sup>4</sup> It so happened that in that year 1987, I had also the chance to listen to an excellent lecture of the young Angel Merkel at a scientific conference in Kühlungsborn, a resort on the Baltic sea shore in East Germany, where also a number of western scientists had been invited to. There Angela Merkel reported about another most important prototypical reaction of physical organic chemistry, the so called  $\text{S}_{\text{N}}2$  reaction system (with the example  $\text{CH}_3\text{F} + \text{H}^- = \text{CH}_4 + \text{F}^-$ ): This work again showed the good taste of Angela Merkel in choosing important topics for her research. This work was carried out in collaboration with the group of Rudolf Zahradnik, a well-known quantum chemist at the academy of sciences and the J. Heyrovsky institute of Physical Chemistry in Prague and published also in an international journal.<sup>5</sup> Angela Merkel on a much later occasion has called Rudolf Zahradnik an (informal) academic teacher of hers. This work again provided a number of most significant results on an important topic, another true pearl in the scientific literature.

There was a further remarkable aspect, which I remember from that meeting in 1987. The interactions with scientists from East Germany, in my past experience, had commonly been characterized by considerable “stiffness” from the eastern partners, an open non-scientific discussion on general and also political matters was essentially impossible. Our Eastern colleagues kept their mouth completely shut, presumably being afraid of the STASI (“Staatssicherheit”, the permanent surveillance of the East German citizens). This stiffness somehow often even extended into the Eastern German scientific presentations and discussions. There were, however, two young scientists at that meeting who stuck out by a completely different behaviour and style: Angela Merkel and Joachim Sauer. The sci-

ence was presented in a most refreshing, clear way at a very high international level (all in English) followed by vivid discussions. Even in private informal discussions they showed this most refreshing attitude expressing open and quite severe criticism of the political system of the GDR (at least when potential STASI people were not present). When I returned from this meeting, crossing by train the border of shame with fence, death strip and soldiers, and with severe controls preventing any escape, I remembered these two young scientists as hope for a better future for East Germany.

### 3. The times change

While I had always been convinced that the kind of socialist dictatorship of East Germany was not sustainable and must fall sooner or later, this happened sooner than I had anticipated. When I was visiting Prague while at a meeting at Bechynie castle near Prague in September 1989 (on a different topic, laser chemistry, kinetics and spectroscopy, Angela Merkel not being present there) there were clear signs of severe cracks in the socialist countries, and already in November 1989 the Berlin wall fell. By the time this happened Angela Merkel as a still young scientist at age 35 had a serious scientific record of 12 scientific publications (one more appeared later in 1992, but clearly reporting work carried out earlier). Based on this Angela Merkel might have started a further successful scientific career, now with freedom to travel and exchange with scientists of western countries worldwide, just as her later husband Joachim Sauer did, who is today a quantum chemist of highest international renown and a professor at the Humboldt University in Berlin.

However, Angela Merkel moved away completely from science into politics already at the end of 1989, starting a truly stellar political career: member of the “Demokratischer Aufbruch” (Democratic Rising) by end of 1989, of which she became speaker in February 1990, deputy speaker of the East German Government of de Maizière from March 1990 to October 1990, the date of reunification, member of the German Parliament (Bundestag) in December 1990, Federal Minister for Women and Youth in the German Government from 1991 to 1994, Minister for Environmental policy in 1994–1998, General Secretary of the Christian Democratic Union (CDU) from 1998 to 2000, president of the CDU from 2000 onwards and finally elected Chancellor of the Federal Republic Germany from 2005 until today. This story can be read in detail in many places, thus I will not further report on it. I shall comment, however, on some aspects related to her scientific background. In many private discussions, which I could have with her since that time, she always struck me by the clear, quite straightforward scien-

<sup>4</sup> A. Merkel and L. Züllicke: *l.c.*

<sup>5</sup> A. Merkel, Z. Havlas, R. Zahradnik: Evaluation of the rate constants for the  $\text{S}_{\text{N}}2$  reaction  $\text{CH}_3\text{F} + \text{H}^- = \text{CH}_4 + \text{F}^-$  in the gas phase. *J. Am. Chem. Soc.* 110 (1988) 8355–8359.

tific rationality of her approach to many important problems. I remember a very long discussion during a visit of mine at the Berlin Academy at the time after she had been minister for environmental policy (from 1994, strictly speaking “Federal Minister for the Environment, Nature Conservation and Nuclear Safety” until 1998). I tried to convince her that giving carbon dioxide a price, for instance by continuously increasing taxes on its emission, would be important to meet the challenges of manmade climate change. She replied that she needed not to be convinced, she was already, but she warned me at the same time, quoting Al Gore who had told her that by increasing tax on gas by just ten cents per gallon in the USA one might risk losing the elections (and he lost in 2000). We know of similar electoral events happening elsewhere in the world, even in Switzerland in recent times. Thus, she understood that “real politics” (Realpolitik) needs the agreement of the people in a democracy. Indeed, in 1997 she published the remarkable book “The price of survival” in this context, giving an account of her visions for a policy of sustainable development.<sup>6</sup> She had been a consistent supporter of the Kyoto and later Paris agreements on climate. At the G8 summit in Heiligendamm in 2007 (her political homeland in Mecklenburg Vorpommern, it so happens also near Kühlungsborn at the Baltic Sea), she strongly promoted measures to protect the Earth’s climate.

#### 4. Conclusion

Angela Merkel, in contrast to many other political leaders, understands and listens to scientists. She keeps contact, among others, for instance to the Leopoldina as the German National Academy of Sciences and one may mention also her remarkable commencement speech at Harvard University in 2019.<sup>7</sup> Thus, I might conclude here with a document from her numerous contacts to the Leopoldina, showing her striking political-scientific foresight in anticipating a future crisis:

<sup>6</sup> A. Merkel: *Der Preis des Überlebens*. Deutsche Verlagsanstalt, Stuttgart 1997. ISBN 3-421-05113-5.

<sup>7</sup> A. Merkel. Commencement speech. Harvard University, 2019.

the current Corona crisis of 2020/2021. Quoting from a speech given in 2015 in a different context, where she addressed numerous questions, also symmetries and asymmetries in politics, as related the theme of that meeting but addressing also many more general political themes, she stated among other things literally in 2015, five years before the crisis arrived.<sup>8</sup>

[...] Notwendigkeit besteht, dass Globalisierung auch Antworten auf die Frage von Epidemien und Pandemien gibt. Insoweit sind wir als Weltgemeinschaft überhaupt noch nicht gewappnet. Wir haben uns vorgenommen, an diesem Thema weiterzuarbeiten. [...] So brauchen wir auch ein globales System der schnellen Reaktion auf globale Herausforderungen durch Epidemien.<sup>9</sup>

Surely, her science based wisdom allowed her to anticipate such problems and to address them rationally. This early understanding by her has helped her government in the actions at least at the start of the pandemic entering Germany, as she was mentally prepared for it. After all, the kinetic behaviour of a pandemic is really very much like chemical reaction kinetics. That she is able to obtain the power and the agreement of her country to support her course of action clearly needs something beyond her scientific background, it is the natural gift of political talent. Personally, I am convinced that the combination of political talent with scientific understanding would be a great help in world politics. It would be desirable, that more political talents with a scientific background and understanding, of which Angela Merkel is the role model, were discovered. ■

<sup>8</sup> A. Merkel. Rede der Bundeskanzlerin bei der Leopoldina September 2015. In: *Symmetrie und Asymmetrie in Wissenschaft und Kunst*, M. Quack and J. Hacker (Eds.). *Nova Acta Leopoldina* 412 (2016) 21–28. Wissenschaftliche Verlagsgesellschaft, Stuttgart.

<sup>9</sup> *Translation*: There is a need, that globalization also answers questions raised by epidemics and pandemics. As to this, the world community is not yet well prepared at all. We plan to work on this topic. [...] Thus, we really need a global system for a fast reaction to global challenges by epidemics.