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**Werner Heisenberg and the German Uranium Project**

**Otto Hahn and the Declarations of Mainau and Göttingen**

## Werner Heisenberg and the German Uranium Project\*

*Horst Kant*

Werner Heisenberg's (1901-1976) involvement in the German Uranium Project is the most controversial aspect of his life. The controversial discussions on it go from whether Germany at all wanted to build an atomic weapon or only an energy supplying machine (the last only for civil purposes or also for military use for instance in submarines), whether the scientists wanted to support or to thwart such efforts, whether Heisenberg and the others did really understand the mechanisms of an atomic bomb or not, and so on. Examples for both extreme positions in this controversy represent the books by Thomas Powers *Heisenberg's War. The Secret History of the German Bomb*,<sup>1</sup> who builds up him to a resistance fighter, and by Paul L. Rose *Heisenberg and the Nazi Atomic Bomb Project – A Study in German Culture*,<sup>2</sup> who characterizes him as a liar, fool and with respect to the bomb as a poor scientist; both books were published in the 1990s.

In the first part of my paper I will sum up the main facts, known on the German Uranium Project, and in the second part I will discuss some aspects of the role of Heisenberg and other German scientists, involved in this project. Although there is already written a lot on the German Uranium Project – and the best overview up to now supplies Mark Walker with his book *German National Socialism and the quest for nuclear power*, which was published in

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<sup>1</sup> Powers, Thomas: *Heisenberg's War. The Secret History of the German Bomb*. Alfred A.Knopf, New York 1993 (German edition: *Heisenbergs Krieg. Die Geheimgeschichte der deutschen Atombombe*. Hoffmann und Campe, Hamburg 1993).

<sup>2</sup> Rose, Paul Lawrence: *Heisenberg and the Nazi Atomic Bomb Project – A Study in German Culture*. University of California Press, Berkeley/Los Angeles/London 1998 (German edition: *Heisenberg und das Atombombenprojekt der Nazis*. Pendo-Verlag, Zürich/München 2001).

1989<sup>3</sup> – unfortunately there is done only relatively little research on the individual groups, which were involved in this project.

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As is well-known, uranium fission was discovered by the two chemists Otto Hahn (1879-1968) and Fritz Straßmann (1902-1980) on December 19th, 1938 at the Kaiser Wilhelm Institute for Chemistry in Berlin. The experimental results were already published in the first 1939-number of the journal *Die Naturwissenschaften*.<sup>4</sup> In a letter Hahn had informed on these experimental results only Lise Meitner (1878-1968), his former physical colleague, who had been in Swedish exile since half a year then. He asked her for a theoretical interpretation, which she found together with her nephew Otto Robert Frisch (1904-1979) during the days of New Year 1938/39.<sup>5</sup> The German physicists – even those of Hahn's institute like Siegfried Flügge (1912-1997), or Carl Friedrich von Weizsäcker (\*1912) at the nearby Kaiser Wilhelm Institute for Physics – learned of Hahn's and Straßmann's results only from the mentioned journal-article, which came out on January 6th, 1939. Within a few days they found the right theoretical interpretation as well.<sup>6</sup> To physicists all over the world it became clear very quickly that this then opened possibility of obtaining atomic energy also meant the possibility of an atomic bomb. The political situation at that time let to the fear that Germany could built such a bomb and use it against the other countries – ironically the date of outbreak of World War II corresponds with the date of publication of the Bohr-Wheeler-theory of the fission-process.<sup>7</sup> The atomic bomb programs in the U.S.A., the Soviet Union and other countries have originated from this fear.

In Germany already in April 1939 the Ministry of Culture and Education (Reichserziehungsministerium) got an information on the possibilities of uranium fission by Georg Joos (1894-1959), then holding the physics-chair at Göttingen, after a colloquium-talk by Wilhelm Hanle

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<sup>3</sup> Walker, Mark: German National Socialism and the quest for nuclear power. 1939-1949. Cambridge University Press 1989 (German edition: Die Uranmaschine. Mythos und Wirklichkeit der deutschen Atombombe. Berlin 1990).

<sup>4</sup> Hahn, Otto & Fritz Straßmann: Über den Nachweis und das Verhalten der bei der Bestrahlung des Urans mittels Neutronen entstehenden Erdalkalimetalle. *Die Naturwissenschaften* 27(1939)1, pp.11-15.

<sup>5</sup> Meitner, Lise & Otto Robert Frisch: Disintegration of Uranium by Neutrons: a New Type of Nuclear Reaction. *Nature* 143(1939, Febr 11)3615, pp.239-240.

<sup>6</sup> Flügge, Siegfried & Gottfried von Droste: Energetische Betrachtungen zu der Entstehung von Barium bei der Neutronenbestrahlung von Uran. *Zeitschrift für Physikalische Chemie B* 4 (1939) pp.274-280.

<sup>7</sup> Bohr, Niels & John Wheeler: The mechanism of nuclear fission. *Physical Review* 56 (1939) pp.426-450. This paper came out on September 1st, 1939. – For the characterization of the whole political situation we only refer here to some special dates: Conference of Munich (29-9-1938), so-called Reichspogromnacht in Germany (9/10-11-1938), German military move into Böhmen and Mähren (15-3-1939), end of the Spanish Civil War (2-4-1939), Italian military move into Albania (7-4-1939), Roosevelt's warning to Hitler and Mussolini, not to continue annexation-policy (14-4-1939), German-Italian-military pact (22-5-1939), and Hitler-Stalin-Pact (23-8-1939).

(1901-1993) on this subject. In its result the so-called “first uranium club” (Uranverein) – not an official name, but more a nickname in private communications<sup>8</sup> – was organized under the leadership of the Reich Research Council (Reichsforschungsrat), which was not very effective for several reasons.<sup>9</sup>

At the same time the army was informed on one hand by their chemical explosives consultant Paul Harteck (1902-1985) from Hamburg, on the other hand (a little bit later) by the industrial physicist Nikolaus Riehl (1901-1990), a former student of Hahn and Meitner and at that time the head of a scientific research department in the Auer Company (which traded in uranium and heavy metals as well as in gas-masks). However, at first the army seemed uninterested. – All these scientists were not connected with the National Socialist movement in any way, but they were probably motivated in varying degrees by patriotism, nationalism and ambition (professional as well as personal) and also economic interests (as in the case of Riehl). Harteck, for instance asked in 1967, why he had written that letter, answered:

“In those days in Germany we got no support for pure science. [...] So we had to go to an agency where money was to be obtained. I was always realistic about such things. The War Office had the money and so we went to them.”<sup>10</sup>

That seems to be opportunistic, but it describes the widespread reality.

In June 1939 Flügge published a review article in the journal *Die Naturwissenschaften*, titled *Kann der Energieinhalt der Atomkerne technisch nutzbar gemacht werden?*, and at the same time he wrote a popular version for the German Newspaper *Deutsche Allgemeine Zeitung*.<sup>11</sup>

After the start of World War II Army Ordnance (Heereswaffenamt) seemed to become interested rather sudden. But in fact the Army Ordnance had collected information on nuclear fission since Harteck's letter and decided to deal more extensively with the uranium problem in August 1939 (after Flügge's article).<sup>12</sup> The Reich Research Council was squeezed out and a so-called “second uranium club” was founded under the leadership of the Army Ordnance in September 1939. At that time, Army Ordnance included weaponry research departments for various scientific disciplines, which were staffed by good, competent scientists. The expert in atomic physics at the Army Ordnance was Kurt Diebner<sup>13</sup> (1905-1964), and his assistant became the young physicist Erich Bagge (1912-1996), a pupil of Werner Heisenberg. Diebner organized a first meeting of this second uranium club in Berlin on September 16, 1939. Among the participants were

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<sup>8</sup> The more official name was “Arbeitsgemeinschaft für Kernphysik”. – See M.Schaaf: *Der Physikochemiker Paul Harteck (1902-1985)*. CENSIS-REPORT-33-99 (Hamburg 1999), p.96.

<sup>9</sup> Members were – among others – Walther Bothe, Peter Debye, Gerhard Hoffmann, Hans Geiger.

<sup>10</sup> Interview with Paul Harteck. In: *Atomic Bomb Scientists. Memoirs, 1939-1945*. Ed. by Joseph J.Ermenc. Westport 1989, pp.77-160 (here p.97).

<sup>11</sup> Flügge, Siegfried: *Kann der Energieinhalt der Atomkerne technisch nutzbar gemacht werden?* *Die Naturwissenschaften* 27(1939)23/24, pp.402-410.

<sup>12</sup> Harteck got an positive answer on his letter from April 24th on August 22nd, 1939.

<sup>13</sup> Diebner, who worked in the Heereswaffenamt since 1934, was a pupil of Gerhard Hoffmann (1880-1945), experimental physicist in Halle (1928-37) and Leipzig (1937-45), who also was involved in the uranium project (cyclotron). Heisenberg had a bad mind of Diebner's scientific competence.

Walther Bothe (1891-1957), Flügge, Hans Geiger (1882-1945), Hahn and others. A second, more important meeting was ten days later in the Army Ordnance. Now among the participants was also Heisenberg, then holding the chair of theoretical physics at the university of Leipzig. Interestingly enough to mention, that the involvement of theoretical physicists was not greeted by all participants, and this remained a source for tension during the whole time.<sup>14</sup> It also has to be noticed, that the scientists were not “invited” in common sense, but they were summonsed by a military call-up.<sup>15</sup>

A detailed plan for the project was worked out; unfortunately we know from this paper only by notices of Bagge and Diebner.<sup>16</sup> But Bagge and Diebner cite their head of department, who made clear in his opening speech, that the question of technical use of nuclear energy was of military interest also with respect to new weapons.<sup>17</sup> In other words, a bomb was to be seen as a possible result (and it would be naïve to believe that the part taking scientists did not see this), but this *military program* firstly was *not* a *direct* bomb program.<sup>18</sup> Heisenberg was charged to investigate the theoretical basis of an uranium machine. Furthermore it was decided to take over the Kaiser Wilhelm Institute (KWI) for Physics in Berlin by the army with the intention of turning it into a center of military uranium research, while several decentralized groups – especially at university institutes – should deal with special questions of the project.

In October 1939 the Army Ordnance informed the Kaiser Wilhelm General Secretary that the Army was requisitioning the Kaiser Wilhelm Institute for Physics for war work. The institute, originally founded in 1917 under Albert Einstein (1879-1955) as a very special construction, had been refounded in the 1930ies, and its laboratories took up work in 1937 under the direc-

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<sup>14</sup> There were especially some animosities between the physicochemist Harteck and Heisenberg and between the experimental physicist Bothe and Heisenberg; furthermore and fore other reasons between Diebner and Heisenberg. [See e.g. Schaaf, op.cit. p.106; also the Farm Hall Transcripts]. The bad mood with Bothe had it's reason not only in the “carbon-measurements” (see later in text), but also in the 1942-discussion for the directorship at the KWI Physik [see H.Kant: Werner Heisenberg und das Kaiser-Wilhelm-Institut für Physik in Berlin. In: Werner Heisenberg – Physiker und Philosoph. Ed. by B.Geyer, H.Herwig, H.Rechenberg; Heidelberg etc. 1993, pp.152-158 (here p.154)]. Conversely Harteck in 1942 argued for Heisenberg instead of Bothe [see Archiv der Max-Planck-Gesellschaft, Abt.I, Rep.1A, No.1652 (notice 22-01-42)].

<sup>15</sup> Thus Heisenberg on 26-09-1939 wrote to the dean of the Philosophical Faculty of the Leipzig University: “Vor einigen Tagen habe ich mitgeteilt, dass ich nach Berlin einberufen worden sei. Inzwischen ist mir von der betreffenden Berliner Stelle gestattet worden, bis auf weiteres in Leipzig zu bleiben. [...]” [Archiv der Humboldt-Universität zu Berlin, Personalakte Heisenberg 185/3, Bl.46].

<sup>16</sup> See e.g. W.Tautorius (that is Diebner): Die deutschen Geheimerarbeiten zur Kernenergieverwertung während des zweiten Weltkrieges 1939-1945. Atomkernenergie 1(1956) pp.368-370 & 423-425. Here under No.1 ist cited E.Bagge, K.Diebner: Vorbereitender Arbeitsplan zur Aufnahme von Versuchen für die Nutzbarmachung der Kernspaltung vom 20.9.1939. – E.Bagge, K.Diebner, K.Jay: Von der Uranspaltung bis Calder Hall. Rowohlt Taschenbuch Verlag Hamburg 1957. – E.Bagge: Fünfzig Jahre als Physiker in Deutschland. Fusion 6(1985)6, pp.26-34 (here p.31).

<sup>17</sup> Bagge, Diebner, Jay: op.cit. p.23.

<sup>18</sup> It may be noticed, that “new weapons” not only restrict on “atomic bombs”.

torship of the Dutch physicist and Nobel laureate Peter Debye (1884-1966).<sup>19</sup> Now, in October 1939, less than two months after the start of the war, Debye was forced to leave his directorship and the institute, if not willing to change his citizenship from Dutch to German. Debye found a compromise with the Ministry of Education and left Germany for a standing offer of a guest professorship at Cornell University in the United States.<sup>20</sup> Diebner now became the administrative head of the Kaiser Wilhelm Institute for Physics, but in fact during the next years only a part of this institute was involved in nuclear fission research.<sup>21</sup> Heisenberg became a scientific advisor of the institute, but remained in his Leipzig position at the university.<sup>22</sup> Diebner was not very much recognized by most of the “civilian” scientists, and therefore the KWI for Physics became a center only in a formal sense, in fact it was not more than one group within the whole uranium project. Among the former assistants of Debye, who became involved in the uranium project at the Kaiser Wilhelm-Institute for Physics, were Horst Korsching (\*1912), Carl Friedrich von Weizsäcker and Karl Wirtz (1910-1994); soon this group was completed by Fritz Bopp (1909-1987), Paul Müller and Karl-Heinz Höcker (\*1915).

The number of scientists, who were involved in the German Uranium Project, was not very much more than seventy to hundred over the times, and they were concentrated to different groups at several universities and Kaiser Wilhelm institutes (see plate 1).<sup>23</sup> – It should be mentioned, that most of the leading scientists in this project did not define its contents very strong, for not at least they tried to use it for saving young scientists from military service at the front. This decentralized organization may have been good for scientific work, for solving a technical problem it was not efficient enough. Among the scientists of the Uranium club Harteck seemed

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<sup>19</sup> Kant, Horst: Albert Einstein, Max von Laue, Peter Debye und das Kaiser-Wilhelm-Institut für Physik in Berlin (1917-1939). In: *Die Kaiser-Wilhelm-/Max-Planck-Gesellschaft und ihre Institute; Studien zu ihrer Geschichte: Das Harnack-Prinzip*. Ed. by Bernhard vom Brocke und Hubert Laitko, Walter de Gruyter Berlin 1996, pp.227-243. – Kant, Horst: Peter Debye und das Kaiser-Wilhelm-Institut für Physik in Berlin. In: *Naturwissenschaft und Technik in der Geschichte (25 Jahre Lehrstuhl für Geschichte der Naturwissenschaft und Technik am Historischen Institut der Universität Stuttgart)*; ed.by Helmuth Albrecht. GNT-Verlag Stuttgart 1993, pp.161-177.

<sup>20</sup> It is interesting to mention, that Debye in this way formally stood on as director of the Kaiser Wilhelm Institute for Physics and also as professor at the University of Berlin – officially he was only on leave nearly until the end of the war (and thus officially he was not an emigrant). But he did not return after the war.

<sup>21</sup> The departments of Max von Laue (1879-1960) and Hermann Schüler (1894-1964) remained in that part of the institute, which furthermore was under administration of the Kaiser Wilhelm-Gesellschaft. Also Ludwig Bewilogua (1906-1983), so far assistant of Debye and a specialist in low-temperature physics, remained in that part of the institute and became its administrative head.

<sup>22</sup> The minutes of a meeting of the senate of the Kaiser Wilhelm Society (from 31-07-1941) with respect to the KWI for Physics record: “Die Leitung hat Dr. Diebner vom Heereswaffenamt, während die wissenschaftliche Hauptleitung in den Händen von Prof. Hahn (Kaiser Wilhelm-Institut für Chemie) und Prof. Heisenberg liegt. Das Heereswaffenamt trägt einen erheblichen Teil des Etats. [...]” [Archiv der Max-Planck-Gesellschaft, Abt.I, Rep.1A, No.1652].

<sup>23</sup> A rather good overview on the scientific work, done during that time, gives the published list of secret papers by Werner Tautorius (op.cit.) – The secret papers can be found in several archives, among others now also in the Deutsches Museum München. – The papers on the project by Heisenberg can be found in Werner Heisenberg: *Collected Works*. Series AII, Springer-Verlag Berlin, Heidelberg etc. 1989, pp.365-601.

to be the only one, who recognized the industrial requirements of such a project.<sup>24</sup> But also in the other countries, where work on an atomic bomb project was done, the scientists themselves did not realize in the beginning the needed gigantic technical efforts. – Furthermore there were certain animosities among the groups: “Each one said that the other was unimportant”, said Korsching later in Farm Hall.<sup>25</sup>

There was another small group working on the uranium problem, and really at times with some ambition for a bomb, and this was the group of Manfred von Ardenne (1907-1997) in his private laboratory, which was connected with the research institute of the Ministry of Post (Reichspostministerium) and its minister Wilhelm Ohnesorge (1872-1962). One important co-worker of this laboratory was – after his deportation from the Soviet Union – Friedrich Houtermans (1903-1966). But this group for several reasons – one main reason was reservation, and often hostility, of most scientists against v.Ardenne – was not connected with the uranium club (despite the fact that there were contacts), and although it should not be underestimated in its role, the results were small and all in all not of greater importance neither for the uranium project nor for the ambitious plans of the minister.<sup>26</sup>

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A first important result within the German Uranium Project was Heisenberg's first secret report "The Possibility of Technical Energy Production from Uranium Fission", dated already from December 6th, 1939, in which he had worked out the theory of energy production through nuclear fission (based on Bohr's and Wheeler's arguments, but obviously without knowing the paper of Peierls on fission with fast neutrons<sup>27</sup>). Its summary contains the significant sentences:

“Die von Hahn und Strassmann entdeckten Spaltungsprozesse an Uran können nach den bisher vorliegenden Daten auch zur Energieerzeugung im Grossen verwendet werden. Die sicherste Methode zur Herstellung einer hierzu geeigneten Maschine besteht in der Anreicherung des Isotops  ${}_{92}\text{U}^{235}$ . Je weiter die Anreicherung getrieben wird, desto kleiner kann die Maschine gebaut werden. Die Anreicherung von  $\text{U}^{235}$  ist die einzige Methode, mit der das Volumen der Maschine klein gegen 1 cbm gemacht werden kann. Sie ist ferner die

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<sup>24</sup> M.Schaaf, op.cit. p.179.

<sup>25</sup> Bernstein, Jeremy: Hitler's Uranium Club. The secret recordings at Farm Hall. American Institute of Physics; Woddbury 1996, p.127. – Although Gerlach vehemently contradicted this statement of Korsching, I think, he was right. See also footnotes 14 & 46.

<sup>26</sup> Stange, Thomas: Die kernphysikalischen Ambitionen des Reichspostministers Ohnesorge. Berichte zur Wissenschaftsgeschichte 21(1998) pp.159-174. – Ardenne, Manfred von: Sechzig Jahre für Forschung und Fortschritt. Berlin 1987.

<sup>27</sup> See P.L.Rose, op.cit. p.107 (p.141 dtsh). – Peierls, Rudolph: Critical Conditions in Neutron Multiplication. Proceedings of the Cambridge Philosophical Society 35(1939) pp.610-615.

einzigste Methode, um Explosivstoffe herzustellen, die die Explosivkraft der bisher stärksten Explosivstoffe um mehrere Zehnerpotenzen übertreffen. Zur Energieerzeugung kann man aber auch das normale Uran ohne Anreicherung von  $U^{235}$  benutzen, wenn man Uran mit einer anderen Substanz verbindet, die die Neutronen von Uran verlangsamt, ohne sie zu absorbieren. [...]<sup>28</sup>

The theoretical group of the uranium-project at the Kaiser Wilhelm Institute for Physics in Berlin was formally under the leadership of C.F. von Weizsäcker, but in fact dominated by Heisenberg, v. Weizsäcker's honored teacher. While Heisenberg was working out the theory of chain reaction, v. Weizsäcker and his group dealt with the development of an uranium machine. In February 1940 he presented together with Müller and Höcker his first secret report "Calculation of Energy Production in the Uranium Machine".<sup>29</sup> In his paper "A possibility of Energy Production from U 238" from July 1940 he discussed the possibility of something similar like the now so-called plutonium-process.<sup>30</sup>

One important factor for running an uranium-machine is the quantity of the neutron multiplication factor, and experiments were run to find it out. One of the first was Harteck, who already in late spring 1940 carried out an interesting experiment with uranium oxide and solid carbon dioxide (dry ice) as a moderator. Although he got for this experiment as much uranium oxide, as was available in the moment,<sup>31</sup> it was not enough and the machine was too small and did not show neutron multiplication. But if there would have been enough material, this "brilliant idea" quite likely would have led to a chain-reacting pile before Fermi.<sup>32</sup>

In his first report Heisenberg had stressed heavy water and carbon as feasible moderators for an uranium machine. As a result of the unsuccessful experiment by Harteck and misinterpreted measurements of neutron absorption by Bothe as well as Heisenberg's calculation that a machine composed of carbon and uranium would require much more material than a heavy water

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<sup>28</sup> Heisenberg, Werner: Die Möglichkeit der technischen Energiegewinnung aus der Uranspaltung. In: Werner Heisenberg. Gesammelte Werke/Collected Works Part AII. Ed. by W. Blum, H.-P. Dürr, H. Rechenberg. Springer, Berlin/Heidelberg/New York 1989, pp. 378-396 (here p. 396).

<sup>29</sup> Carl-Friedrich von Weizsäcker, Paul Müller, Karl-Heinz Höcker: Berechnung der Energieerzeugung in der Uranmaschine. G-60; unpublished report (26 Feb 1940).

<sup>30</sup> Weizsäcker, C.F.v.: Eine Möglichkeit der Energiegewinnung aus U 238. G-59; unpublished report (17 July 1940). But Weizsäcker here discusses the process only with respect to element 93 (then so-called Eka-Rhenium, now Neptunium). – Kurt Starke discovered – independently from American researchers – element 93 at the Kaiser Wilhelm Institute for Chemistry in 1940/41 [secret report 20 May 1941]. Houtermans (from the Ardenne-institute) in 1941 predicted that an element >93 should be better suitable for fission. Because of lacking a strong neutron source the German scientists did not find element 94; Starke had looked for it in 1943/44, when he worked in German-occupied Paris at the cyclotron of F. Joliot-Curie, but was not successful [see Starke, Kurt: Transuranium research in Germany 1939 to 1945. *Atomkernenergie/Kerntechnik* 41(1982)4, pp. 264-266. – Cornelius Keller: Die Geschichte der Radioaktivität. Stuttgart 1982, p. 45]. Thus the German scientists in principle knew of the possibility of the plutonium-process, but nothing more.

<sup>31</sup> M. Schaaf, op.cit. p. 116.

<sup>32</sup> J. Bernstein, op.cit. p. 24.

devise, German scientists concentrated their efforts on a heavy water machine.<sup>33</sup> In August 1940 Robert Döpel (1895-1982) from Heisenberg's Leipzig group demonstrated experimentally that heavy water was an excellent moderator, which implied that a machine built from natural uranium and heavy water should work.<sup>34</sup>

Let us add here a short notice on Bothe. Since Farm Hall it was claimed among the scientists around Heisenberg, that Bothe's measurements regarding carbon had been wrong,<sup>35</sup> and this would have been one reason for the failing of a German reactor during war-time. But in 1980 some former students of Bothe repeated those measurements and could find, that Bothe and Peter Jensen (1913-1955) had not only been right in 1941, but that Heisenberg had not sufficient kept to their error analysis.<sup>36</sup>

It's interesting to notice, that this secret paper of Bothe and Jensen was published in 1944 in *Zeitschrift der Physik!*<sup>37</sup> Also other things in this context were astonishingly published after 1942, for instance the discovery of element 93 in the KWI for Chemistry by Kurt Starke (1911-2000) – first mentioned in a secret paper in May 1941, and published in *Die Naturwissenschaften* in autumn 1942.<sup>38</sup>

Inside the uranium program the years of 1941 and 1942 were dominated by “model experiments” with respect to an uranium machine. But the experimental program progressed slowly, for only little amounts of uranium and heavy water were available. At the KWI for Physics Karl Wirtz and his co-workers studied a plane layer arrangement of uranium and heavy water, while Döpel in Leipzig used a spherical layer-geometry, based on an idea of Heisenberg.<sup>39</sup> In autumn 1941 the results of these Leipzig experiments were encouraging. In May 1942 – one month before the Chicago team with Enrico Fermi (1901-1954) gained positive results – the Leipzig

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<sup>33</sup> The available uranium-stocks were short, Germany had the mines in the Erzgebirge and after Czech occupation of St.Joachimsthal; after the occupation of Belgium it could confiscate a certain quantity from Belgian-Congo. On the other hand the technological process for producing pure reactor-uranium – which was developed by Riehl and co-workers at the Auer company – was only at its beginnings and the output was not very high. – The heavy water was imported from Norway. Efforts for a sizable production in Germany were not successful.

<sup>34</sup> On Robert Döpel see a collection of articles in: *Beiträge zur Geschichte von Technik und technischer Bildung*, Folge 13, ed. by L.Hiersemann. Hochschule für Technik, Wirtschaft und Kultur Leipzig 1995.

<sup>35</sup> Heisenberg, W.: Research in Germany on the Technical Application of Atomic Energy. *Nature* 160(1947) No.4059, pp.211-215 (here p.212). – Heisenberg, Werner: *Der Teil und das Ganze*. München 1969, p.245. – See also J.Bernstein, op.cit. p.366.

<sup>36</sup> Koester, L.: Zum unvollendeten ersten deutschen Kernreaktor 1942/1944. *Naturwissenschaften* 67(1980) pp.573-575. – See also M.Walker: *Die Uranmaschine*. op.cit. p.40.

<sup>37</sup> Bothe, W. u. Jensen, P.: Die Absorption thermischer Neutronen in Kohlenstoff. *Zeitschrift für Physik* 122(1944) pp.749-755.

<sup>38</sup> Starke, K.: Anreicherung des künstlich radioaktiven Uran-Isotops  $U^{239}$  und seines Folgeproduktes  $93^{239}$  (Element 93). Secret paper 20-05-1941. – Starke, K.: Abtrennung des Elements 93. *Die Naturwissenschaften* 30(1942)7, pp.107-108. – Starke, K.: Anreicherung des künstlich radioaktiven Uran-Isotops  $^{239}U_{92}$  und seines Folgeproduktes  $^{239}93$  (Element 93). *Die Naturwissenschaften* 30(1942)38/39, pp.577-582. – See also footnote 30.

<sup>39</sup> One important aspect of the Leipzig arrangement was, that it needed less material than the Berlin arrangement.

group could validate in experiment the positive neutron-production.<sup>40</sup> That means, that with respect to the scientific results – regarding the reactor, not the bomb – the German program in spring 1942 was on a similar level than for instance the American or the British programs.

But at that time the question on the further progress of the German program was more or less decided. At the end of February 1942 a three-days conference on the uranium project took place in Berlin at the KWI for Physics, and furthermore for the last day, the 26th of February, a popular lecture series, sponsored jointly by the Army Ordnance and the Reich Research Council for a restricted audience, was set up to provide a showcase for nuclear power. Among other things the whole conference-program shows that the German project was mainly divided into three parts: the production of uranium and heavy water, uranium isotope separation, and uranium machines. Without going into detail here we can summarize the results in this way, that with the exception of uranium isotope separation all the other aspects of research made relatively good progress.

While the conference was naturally mainly concentrated on scientific questions, the following special meeting (see plate 2) makes clear that all participating scientists must also have been fully aware of the military importance of this research, that means they must have been known, that an atomic bomb – whatever shaped in detail – was the main purpose of this military program, which they were involved in. I stress this point, for after the war many German nuclear scientists (among them Heisenberg and v.Weizsäcker) spread the view that German scientists did not build an atomic bomb, because they did not want to built one. Surely, by different reasons, some wanted it more and some wanted it less, but as Wirtz pointed out later:

“Es ist wichtig, festzustellen, [...] daß auch deutsche Wissenschaftler von Anfang an keinen Zweifel darüber ließen, daß eine Atombombe das schließliche Ergebnis einer solchen Entwicklung sein könnte.”<sup>41</sup>

In this connection the scientists saw this February-meeting also as an opportunity to secure financial and material support for their research from industry and/or army. – On the other hand there are several signs, which substantiate, that the German scientists did not believe – for what reasons whatever –, that a bomb will be possible during the war or in a near future, and therefore they did not focus their efforts on it. Thus, Heisenberg for instance wrote to the friendly historian Hermann Heimpel (1901-1988) already in October 1941 (of course a little bit vague):

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<sup>40</sup> R.Döpel, K.Döpel, W.Heisenberg: Der experimentelle Nachweis der effektiven Neutronenvermehrung in einem Kugel-Schichten-System aus D<sub>2</sub>O und Uran-Metall. G-136; unpublished report (July 1942) [see: Werner Heisenberg, *Collected Works Part AII*; op.cit.].

<sup>41</sup> Wirtz, Karl: *Im Umkreis der Physik. Kernforschungszentrum Karlsruhe 1988*, p.38. – And Riehl remarked in the same context: “Wenn es heißt, die deutschen Wissenschaftler wollten - bewußt oder unbewußt - dem Hitler-Reich nicht zur Atombombe verhelfen, so ist das nicht die ganze Wahrheit.” [Nikolaus Riehl: *Erinnerungen an Otto Hahn und Lise Meitner. Schriften des Willi-Graf-Gymnasiums München, München 1988*, p.13.]

“[...] Denn vielleicht erkennen wir Menschen eines Tages, daß wir tatsächlich die Macht besitzen, die Erde vollständig zu zerstören, daß wir also durch eigene Schuld durchaus einen ‘jüngsten Tag’ oder so etwas, was ihm nahe verwandt ist, heraufbeschwören können. Doch es ist wohl noch Phantasterei, das zu denken.”<sup>42</sup>

In fact, this lecture afternoon in February 1942 was successful in a rather curious manner. On one hand it became clear that the construction of an energy producing machine as well as of an atomic bomb would be possible, but neither in military nor in other aspects nuclear energy would be applicable during a year or any other comparable period. With respect to the military and economic situation of Germany at that time the leading military persons in the project came to the conclusion that an atomic bomb would not be available for Germany during this war and they stopped their commitment. But on the other hand it became clear that nuclear energy could be a weapon of the future – with regard to both, military and nonmilitary – and therefore other financial funds were opened for the project (furthermore including a special amount by the army). The definitive decisions on the future of the uranium project came after a conference in June 1942, in which the new Minister for armament and munitions Albert Speer (1905-1981) took part.<sup>43</sup> The uranium project again came under administration of the Reich Research Council, which soon was withdrawn from the Ministry of Culture and Education and came under the presidency of Hermann Goering (1893-1946) and thus indirectly of his air force, but carried on as a more or less civilian organization; his “authorized representative for the Uranium Project” (“Bevollmächtigter für das Uranprojekt”) became at first Abraham Esau (1884-1955), the President of the Physikalisch-Technische Reichsanstalt, and from January 1944 on Walther Gerlach (1889-1979), then holding the chair of experimental physics at the university of Munich.<sup>44</sup> In fact, the Reich Research Council intended to control nuclear power research as completely as the army had done, but first of all, the reactor was now the goal. With the date of July 1st, 1942 the KWI for Physics was given back to the Kaiser Wilhelm Society.<sup>45</sup> As Debye would not return in the foreseeable future, a new director had to be appointed. After some wrangling behind the scenes Heisenberg was called;<sup>46</sup> he left Leipzig and took over his new position at the KWI and

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<sup>42</sup> Letter of W.Heisenberg to H.Heimpel on October 1st, 1941 [Werner Heisenberg-Archiv im MPI für Physik, München].

<sup>43</sup> Conference on June 4th, 1942 in the Harnack-Haus of the Kaiser Wilhelm Society. – Speer became Minister for armament and munitions [Reichsminister für Bewaffnung und Munition] in February 1942, and up from September 1943 he won more influence as Minister for armament and war production [Reichsminister für Rüstung und Kriegsproduktion].

<sup>44</sup> Heinrich, R. & H.-R.Bachmann: Walther Gerlach. Physiker – Lehrer – Organisator. München 1989.

<sup>45</sup> In March 1943 the Army Ordnance also retired from Diebner's group in Gottow and he then came under administration of the Physikalisch-Technische Reichsanstalt.

<sup>46</sup> Some people favored Bothe. – See D.Hoffmann, H.Kant, H.Laitko: Walther Bothe – Wissenschaftler in vier Reichen. Forschungsschwerpunkt Wissenschaftsgeschichte und Wissenschaftstheorie, Preprint No. 26/95, Berlin 1995, p.10. – See also footnote 14.

also a chair at the University of Berlin.<sup>47</sup> With reverence to Debye Heisenberg was not entitled “director *of* the institute” but “director *at* the institute”.

During his time in Berlin Heisenberg's primary aim was to realize the decisive experiment of a self-sustaining nuclear fission chain reaction for energy production in an uranium machine. During 1944 five greater experiments with different layer arrangements were run in Berlin. But the lack of material caused a lot of difficulties. In November/December 1944 the last Berlin experiment was run, the so-called B-VII, and in comparison with the former ones it led to the best neutron production.

For reasons of war-development already during 1943 the evacuation of important institutions from Berlin had begun, among them also institutes of the Kaiser Wilhelm Society. Hechingen, a small place in South-Germany, was chosen as a location for the KWI for Physics. The KWI for Chemistry with Hahn went to the small town Tailfingen, also in South-Germany, while for instance Diebner's group in 1944 found quarters in Stadtilm in Thuringia and Harteck's group in autumn 1944 in Celle (northern of Hannover)<sup>48</sup>.

While the series of experiments was continued in Berlin, a new uranium machine experiment was prepared in Hechingen. For the first time the Heisenberg-group used a lattice-construction, which previously was already suggested by Diebner. This experiment, which was called B-VIII and proved to be the final German one, was carried out in February 1945 in a rock cellar in the nearby village Haigerloch, and it came very close to a self-sustaining chain reaction.

But a few weeks later the German Uranium Program was brought to a sudden and definite end. Allied armies invaded Germany, and in the middle of April the American ALSOS mission captured the main German nuclear scientists, among them Diebner, Hahn, Heisenberg, and v.Weizsäcker, and after some weeks they were detained at Farm Hall in Britain.<sup>49</sup> – Interesting fact: Bothe was not among this group.<sup>50</sup>

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When the German scientists, detained in Farm Hall, on August 6th 1945 heard the news that an atomic bomb had been perfected and used by the Allies over Hiroshima, they – two days later

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<sup>47</sup> On the other hand v.Weizsäcker was appointed to Strassburg university, but remained in close connection with the Berlin group at the KWI for Physics. - See Kant, Horst: *Zur Geschichte der Physik an der Reichsuniversität Straßburg in der Zeit des Zweiten Weltkrieges*. Max-Planck-Institut für Wissenschaftsgeschichte, Preprint No.73, Berlin 1997.

<sup>48</sup> Stumpf, H.F.: *Kernenergieforschung in Celle 1944/45*. Celle 1995.

<sup>49</sup> Finally the group consisted of Erich Bagge, Kurt Diebner, Walther Gerlach, Otto Hahn, Paul Harteck, Werner Heisenberg, Horst Korsching, Max von Laue, Carl Friedrich von Weizsäcker and Karl Wirtz.

<sup>50</sup> One reason for this may be Bothe's good relations with F.Joliot-Curie.

on the suggestion of Major Rittner, the responsible Farm Hall commander – prepared a Memorandum on their own work, in which they emphasized:

“[...] Towards the end of 1941 the preliminary scientific work had shown that it would be possible to use the nuclear energies for the production of heat and thereby to drive machinery. On the other hand, it did not appear feasible at the time to produce a bomb with the technical possibilities available in Germany. Therefore the subsequent work was concentrated on the problem of the engine for which, apart from uranium, heavy water is necessary.

[...] With regard to the atomic bomb the undersigned did not know of any other serious research work on uranium being carried out in Germany.”<sup>51</sup>

(The last sentence – although in its essential part quite correct – at least again demonstrates the more or less ignorance of M.v.Ardenne and his team.)

With respect to this statement, the scientific head of the ALSOS mission Samuel Goudsmit (1902-1978) pointed out in 1947:

“[...] It is true that the German scientists were working on a uranium machine and not the bomb, *but it is true only because they failed to understand the difference between the machine and the bomb*. The bomb is what they were after. And what the whole world knows now about plutonium, *the German scientists did not know – until they were told about it after Hiroshima*.”<sup>52</sup>

And also Paul Rosbaud (1896-1963), scientific editor of the journal *Die Naturwissenschaften* before and during the war and familiar with the leading German nuclear scientists – he was not only anti-Nazi, but an Allied agent for this reason – wrote in his review in 1959 on Robert Jungk’s book *Brighter Than a Thousand Suns* (which was first published in 1956 and gave a very transfiguring picture of the German efforts):

“The Germans knew that in principle a bomb *could* be made; they had no idea *how*. A detailed theory of the A-bomb had never been developed in Germany and the concentration and separation of U235 was more or less unsuccessfully tried [...] As far as the

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<sup>51</sup> J.Bernstein, op.cit. p.158. The original German text is (p.161/162):

“[...] Die wissenschaftlichen Vorarbeiten hatten gegen Ende 1941 zu dem Ergebnis geführt, daß es möglich sein werde, die Kernenergie zur Wärmeerzeugung und damit zum Betrieb von Maschinen zu benutzen. Dagegen schienen die Voraussetzungen für die Herstellung einer Bombe im Rahmen der technischen Möglichkeiten, die Deutschland zur Verfügung standen, damals nicht gegeben zu sein. Die weiteren Arbeiten konzentrierten sich daher auf das Problem der Maschine, für die außer Uran schweres Wasser notwendig ist.

[...] Zur Frage der Atombombe sei noch festgestellt, daß den Unterzeichneten keine ernstzunehmenden Untersuchungen etwa anderer Gruppen in Deutschland über das Uranproblem bekannt geworden sind.”

[see also Hoffmann, Dieter (Ed.): Operation Epsilon. Die Farm-Hall-Protokolle oder Die Angst der Alliierten vor der deutschen Atombombe. Rowohlt Verlag Berlin 1993, pp.175-177].

<sup>52</sup> S.A.Goudsmit: ALSOS. Los Angeles/San Francisco 1983, p.139 (original published in 1947).

reviewer is aware, no member of the German U-team has admitted this ignorance of how to prepare a bomb.”<sup>53</sup>

In my opinion in this last sentence lies one of the main problems and also a key for many last-time-discussions. The German scientists had declared after the war, that they *did* know *how to built* a bomb but *they didn't want* to do it, for they were against Hitler. At first I think it has to be seen clear that there were not *the German scientists*, but that this was a very differentiated group with persons among them, which wanted more, and others, which wanted less to built a bomb. One reason for this was, that some were Nazi and some were anti-Nazi, but this is only one reason within a wider range, for there were also anti-Nazi scientists, who wanted the success. Already in a letter from April 1959 Max von Laue (1879-1960), also detained in Farm Hall, although not involved in the Uranium program,<sup>54</sup> pointed out to Rosbaud to take attention of this important aspect, but then remarked in connection with the discussions after August 6th, 1945:

“[...] Later, during the table conversation, the version was developed that the German atomic physicists really had not wanted the atomic bomb, either because it was impossible to achieve it during the expected duration of the war or because they simply did not want to have it at all. The leader in these discussions was Weizsäcker. I did not hear the mention of any ethical point of view. Heisenberg was mostly silent.”<sup>55</sup>

I think, a lot of facts speaks for the version, that Heisenberg and Weizsäcker – and especially Hahn – were among those scientists, who were less interested in a bomb project.<sup>56</sup> At that time not so much for ethical reasons, as especially Weizsäcker in later times tried to make believe the public,<sup>57</sup> but for a lacking interest in technical (and military) problems; it seems that only Hahn

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<sup>53</sup> P.Rosbaud: Review of ‘Brighter Than a Thousand Suns’ by Robert Jungk. Discovery 20(March 1959), pp.96-97 (here p.96).

<sup>54</sup> Laue had been vice-director of the Kaiser Wilhelm Institute for Physics also during the war, and therefore the Allies had thought, that he should know details of the uranium project.

<sup>55</sup> In German original: “[...] Allmählich entwickelte sich dann auch, in Tisch-Gesprächen, die Lesart, die deutschen Kernphysiker hatten die Atombombe gar nicht haben wollen, sei es, weil sie es während der zu erwartenden Kriegsdauer für unmöglich hielten, sei es, weil sie überhaupt nicht wollten. Führend war bei diesen Diskussionen war [sic] Weizsäcker. Ethische Gesichtspunkte habe ich dabei nicht gehört. Heisenberg saß zumeist stumm dabei.” [Quotation after J.Bernstein, op.cit. pp.385-389]. – Laue in this letter however stressed, that he writes this “[...] not for the public but to you with the request that you keep this letter private until the appropriate time.”

<sup>56</sup> For instance, Hahn noticed in his diary of that time under Aug 6th, 1945: “[...] Schließlich habe ich das gute Gewissen, daß ich weder bei der Entdeckung noch später die Uranspaltung als Kriegsmittel einsetzen wollte; daß ich ja erst glücklich war, als ich (1939 oder) 1940 hörte, eine Bombe könne erst nach einer laufenden Maschine kommen, und daß Jahre notwendig seien, bis man an eine laufende Maschine denken könne. – Ich freue mich jetzt, daß wir keine Mittel und Wege hatten, eine Bombe zu entwickeln, [...]”. [Archiv der Max-Planck-Gesellschaft, NL Hahn, Abt.III, Rep.14B, No.421-2 (Tagebuch No.2), p.22].

<sup>57</sup> In later times Weizsäcker modified this in that way, that he now thinks, that they saw themselves in the dilemma, that they would not built the bomb for Hitler, but probably for Germany. [See e.g. interview 1993 with Weizsäcker in D.Hoffmann: Operation Epsilon, op.cit. pp.331-360 (esp. p.338f). – Also in an interview, which the author had with Weizsäcker in March 1996 (unpublished), he argued similar].

really had some serious scruple. Others were less interested in a bomb project, but wanted success with an uranium machine, like Harteck and Gerlach, and in some respect also Heisenberg.

When Heisenberg and v. Weizsäcker – in their own view – had solved the fundamental theoretical problems of the fission process and the uranium machine in 1940, they both soon lost interest in this matter and left detailed further research mostly to their collaborators like Höcker, Müller and Wirtz in Berlin and Döpel in Leipzig. Heisenberg himself began to deal with problems of elementary particle physics again and in 1943 and 1944 published some articles on this subject,<sup>58</sup> which led to the so-called “S-matrix theory” to describe the scattering and emission problem in the theory of elementary particles.<sup>59</sup> Already in November 1942 he had discussed his first thoughts on this new theory on a lecture-tour in Switzerland. And again he discussed these problems in October 1943 during a tour through the Netherlands and Denmark, which with respect to the political and war-situation later led to some serious discussion of his political sense and instinct.<sup>60</sup> – Weizsäcker among other things continued working on cosmological problems<sup>61</sup> and published his first philosophical book on the physics’ conception of the world.<sup>62</sup> Compare this with the scientists engaged in the Manhattan-Project, who were fully concentrated on their weapons research!

When Heisenberg entirely came to Berlin at the end of 1942, he took over “normal” academic duties – from a regular course on theoretical physics at the university to various academic lectures, e.g. on “The physics of the atomic nucleus” (already realized in spring 1942).<sup>63</sup> Weizsäcker at the end of 1942 was appointed to the chair on theoretical physics at the new organized German University at Strassburg and he took Höcker with him as assistant. Of course Weizsäcker kept involved in the uranium project and periodically took part in discussions in Berlin, but he also had to spend an important amount of his time for normal academic duties.<sup>64</sup> If these

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<sup>58</sup> Heisenberg, Werner: Die beobachtbaren Größen in der Theorie der Elementarteilchen. *Zeitschrift für Physik* 120(1943) pp.513-538; 120(1943) pp.673-702; 123(1944) pp.93-112. – The probably forth part of this work was presented by Heisenberg in 1944 on a colloquium at Zurich. [See Cassidy, David C.: *The Life and Science of Werner Heisenberg*. New York 1992, pp. 475, 480.]

<sup>59</sup> See e.g. Rechenberg, Helmut: The early S-matrix theory and its propagation (1942-1952). In: L. M. Brown, M. Dresden, L. Hoddeson (Eds.): *Pions to Quarks: Particle Physics in the 1950s*. Cambridge 1989, pp.551-578.

<sup>60</sup> While Rose and others emphasize Heisenberg’s propaganda statements on Germany winning the war etc. (see e.g. Rose, op.cit. p.282 ff), others emphasize that Heisenberg helped to preserve scientific institutions in those countries from deeper German influence (see e.g. Rechenberg, op.cit. p.559 f).

<sup>61</sup> See e.g. C.F.v.Weizsäcker: Über die Entstehung des Planetensystems. *Zeitschrift für Astrophysik* 22(1943) pp.319-355.

<sup>62</sup> Weizsäcker, Carl Friedrich von: *Zum Weltbild der Physik*. Leipzig 1943.

<sup>63</sup> Kant, Horst: Werner Heisenberg und das Kaiser-Wilhelm-Institut für Physik in Berlin. op.cit.

<sup>64</sup> Kant, Horst: Zur Geschichte der Physik an der Reichsuniversität Straßburg in der Zeit des Zweiten Weltkrieges. op.cit. – Kant, Horst: Carl Friedrich von Weizsäcker als Physiker in Berlin (1936-1942). In: *Erfahrung des Denkens – Wahrnehmung des Ganzen; Carl Friedrich von Weizsäcker als Physiker und Philosoph*. Ed. by P.Ackermann, W.Eisenberg etc. Berlin 1989, pp.202-210.

scientists would have been keen on constructing a bomb, would they have dealt with other problems?

One main point of scientific critique is, that Heisenberg and the other German scientists did not really understand the principle of an U235-bomb. I think, if the construction of a bomb will be taken as the primary goal, this seems to be right. In his first secret-paper from December 1939 Heisenberg indeed only gave a rough description of such a device, and it is not quite clear, if he really meant a bomb or only a reactor with enriched U235. And especially his first reaction in Farm Hall on the news of the American bomb seems to prove, that he had no clear idea of an U235-bomb and even had not thought of the possibility of using fast neutrons in a pure U235-device for a bomb. But after a first shock, Heisenberg remarks: "If it has been done with uranium-235, then we should be able to work it out properly."<sup>65</sup> A little bit later he confessed in a discussion with Hahn:

"[...] but quite honestly I have never worked it out as I never believed one could get pure '235'. I always knew it could be done with '235' with fast neutrons [...]."<sup>66</sup>

And a few days later, on August 14th, Heisenberg gave a lecture in Farm Hall where he by and large presented the right calculation.<sup>67</sup> But – as for instance Edward Teller (\*1908), a former student of Heisenberg – pointed out, also this calculation contained a typical "mistake of a beginner", which showed him, "[...] that Heisenberg did not put any real effort into the development of the atomic bomb".<sup>68</sup> (Don't forget, that also the American and British scientists had no idea of the right critical mass, before Peierls and Frisch found it out in spring 1940, but it took again some time, before it was accepted by the Americans.)

In a lecture, which Hahn gave in October 1943 in Stockholm and Gothenburg, he ended with pointing on the possibility of chain reaction and atomic energy production, but in a sideline he reflects only on slow neutrons. And he stressed:

"[...] Aber auch hier wachsen die Bäume nicht in den Himmel".<sup>69</sup>

Was this only a careful formulation abroad, or was it an indication, that the Germans were far away from a realization, and furthermore that they did not deal with fast neutrons?

Heisenberg never worked it out, for he believed his first rough calculation, and we can believe him, that he was lucky to see, that such a great amount of U235 was needed, which could not be produced in a short time also under best conditions. Don't forget, that the official propa-

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<sup>65</sup> J.Bernstein, op.cit. p.125.

<sup>66</sup> J.Bernstein, op.cit. p.138.

<sup>67</sup> W.Heisenberg (ed. by H.Rechenberg): Über die Uranbombe. *Physikalische Blätter* 48(1992)12, pp.994-1001. – See also J.Bernstein, op.cit. pp.217-232.

<sup>68</sup> Quotation after M.Schaaf, op.cit. p.152. – See also J.Logan: *The Critical Mass*. *American Scientist* 84(1996, May-June) pp.263-277.

<sup>69</sup> Hahn, Otto: *Umwandlungen der chemischen Elemente und die Zerspaltung des Urans*. *Chalmers Tekniska Högskolas handlingar* No.28 [1944], pp.3-9 (here p.9).

ganda, which influenced also scientists more or less, at the beginning spoke of a short war. Thus he did not favor an U235-bomb, but he saw the possibility of the machine (reactor) and of course the political and economical advantage for a state, which could make use of such a weapon (in long range also of a real weapon, which was not excluded).

Goudsmit, Rose and others argue that Heisenberg was untruth, when he said, he knew that a U235-bomb could be done with fast neutrons, and that he had not really understood the problem.<sup>70</sup> But it seems more imaginable, that he knew in principle, but did not calculate, for he feared by himself, that he may find a result, which would suggest that a bomb may be possible in shorter times. On the other hand he could point to the possibility of a plutonium bomb with less danger, for plutonium was only possible with the help of a working reactor; but in that case it was also not necessary to calculate a plutonium-bomb-devise already at that time. – Here we come back to Rosbaud's comment, that the Germans never admitted not having calculated the U235-process exactly. I think, he is right, but one reason for this behavior seems to be the future problem to claim *then* for more resistance in their behavior, as there really was.

Furthermore it seemed irritating for some people, that the German scientists in Farm Hall first could not believe that the Allied scientists already had realized the reactor and the plutonium-process. In a certain sense this surely owes to a certain arrogance: to get hold of the idea that no other could be better. On the other hand one has to take into account that it was their hope during the war, to have something like a “security” [“Faustpfand”] after the war, which could be of interest for others and which could help to knot new connections then, thus giving Germany a new chance. This may be found to be a naïve or simple or even arrogant thinking, but one should remember, that also after World War I a widespread slogan was that of the irreplaceable role of science for the future, which no victor can take away, and German scientists stood in that tradition.<sup>71</sup> Now they saw, that also this hope was destroyed. May be it is difficult to understand from our contemporary point of view, that there was such a strange German patriotism, which favored a powerful Germany after the war without seeing the dangers of the Nazi-regime (although Heisenberg and others refused this regime).

The fact that Heisenberg did not emigrate, at least not in 1939, when he was on a lecture-tour through the United States, did blame him in the eyes of many people abroad, German émigrés as well as western scientists. And his statements and behavior towards colleagues in other (occupied) countries with respect to Nazi Germany before and during the war may often be judged with good reason as more than only naïve and/or insensitive – I cannot discuss these

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<sup>70</sup> See e.g. Rose, op.cit. p.212f.

<sup>71</sup> See e.g. Max Planck in his academic speech on Leibniz-day 1919: “Denn die Wissenschaft gehört mit zu dem letzten Rest von Aktivposten, die uns der Krieg gelassen hat [...] Und gerade diese idealen Güter werden uns am allernötigsten sein, wenn wir auf die Wiederaufrichtung unseres Vaterlandes hoffen wollen [...]”. [Sitzungsberichte der Preußischen Akademie der Wissenschaften zu Berlin 1919, p.548]

aspects here in detail – but when the critics doubt in his and others honest confession of “loving” Germany in such a time, I will remind them to a comparable statement, which is reported on J.Robert Oppenheimer (1904-1967). When he was asked after the Oppenheimer hearings by George Kennan (\*1904) – a former US-Ambassador in Russia –, whether he had not thought of taking residence outside this country, his reaction is described as following: “His answer, given to me with tears in his eyes: ‘Damn it, I happen to love this country.’”<sup>72</sup> Of course, both situations were different, but I think in a certain sense comparable.

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I have not mentioned here Heisenberg’s and v.Weizsäcker’s visit to Niels Bohr (1885-1962) in autumn 1941; with respect to this I only refer to Michael Frayns drama *Copenhagen* (1998) and the concerned discussions and comments of the last time.<sup>73</sup> – Another interesting point, worth to be discussed in this context, is the position of Heisenberg and his German co-atomic-scientists, taken after the war on using atomic energy for military and/or non-military purposes. Under the provisions of the Allied Control Law No.25 any applied nuclear research was largely banned in post-war Germany, which included nuclear reactor research, isotope studies and cyclotron construction. This implied nearly all those subjects to which Heisenberg and most of his co-workers wanted to return. Very early, the scientists around Heisenberg and v.Weizsäcker were seeking for ways and means to play down this ban, or even to stop its being in force any longer, and Hahn – now in his role as president of the Max Planck Society, the successor of the Kaiser Wilhelm Society – also supported these efforts.<sup>74</sup> Around the years 1954/55 the escalation of the cold war on the one hand and the growing anti-atomic-war-movement on the other also reached Germany’s public, and the public also expected a statement of the scientists. The German atomic scientists – although in its majority taking the view that protests and appeals would be of no avail since they manifestly would fly in the face of politics<sup>75</sup> – came to realize

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<sup>72</sup> Cit. after D.Royal: The story of J. Robert Oppenheimer. New York 1969, p.165.

<sup>73</sup> Frayn, Michael. *Copenhagen* (Drama). Anchor Books, New York 2000. [German edition with comments: Frayn, Michael: *Kopenhagen*. Mit zwölf wissenschaftshistorischen Kommentaren, zusammengestellt von M.Dörris. Göttingen 2001]. – Also the recently published recollections of Bohr on this visit on the Web site of the Niels Bohr Archive [<http://www.nbi.dk/NBA/papers/docs/cover.html>] – although important as historical source in itself – do not give really new insights in what truly has taken place during that controversial visit and especially during the private Heisenberg-Bohr-conversation.

<sup>74</sup> The Allied Control Law No.25 was relaxed in 1949 and transformed in 1950 to the Allied High Commission Law No.22, but experimental and applied nuclear research (for instance in connection with a reactor) were permitted until as late as 1955.

<sup>75</sup> See for instance Hahn to B.Berneis on 27-11-1953: “[...] Aber Proteste und Aufrufe nützen doch offenbar nichts; wir alle wissen ja, dass sowohl die Amerikaner wie auch die Russen als Völker keinen Krieg wollen. Die Politik ist offenbar stärker als alle Aufrufe und Proteste.” [Archiv der Max-Planck-Gesellschaft, NL Hahn, Abt.III, Rep.14A, No.267, p.2].

that their designs for conducting nuclear research under “normal conditions” would be best served when making clear that they had only an exclusive interest in a “peaceful nuclear research”. In this situation the German Atomic scientists launched the *Declaration of Mainau* against atomic weapons (1955) and the *Declaration of Göttingen* (1957) against nuclear armament of the Federal German Army. With both declarations Hahn, Heisenberg and v. Weizsäcker were exceptionally engaged in, but here is not the place to discuss this in more detail.<sup>76</sup>

To close, I will quote Jean Medawar and David Pyke in a recently published book on Nazi emigrants, who also reflected on Heisenberg’s role in the uranium project and the time after; I think this comment possibly comes nearby truth:

“Heisenberg’s reputation was clouded by his failure to explain his wartime record satisfactorily. But then, whatever account he and his colleagues gave of the war years (apart from von Laue and Hahn, who thanked God that they had failed to make a bomb), they were trapped in a dilemma: they did not want the Allies to think they had worked on a bomb for Hitler, but were equally reluctant to face condemnation by their countrymen, either as traitors or as incompetents, for having failed to produce one.”<sup>77</sup>

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<sup>76</sup> I have discussed some background to this subject in my paper *Otto Hahn and the Declarations of Mainau and Göttingen* on the conference HISAP’99, which follows as second part of the present Preprint.

<sup>77</sup> J. Medawar & D. Payke: *Hitler’s Gift. The True Story of the Scientists Expelled by the Nazi Regime*. New York 2001, p.178.

Plate 1

Research Groups within the German Uranium Project (1940-42)

[The number of persons is only a rough guess, based on Mark Walker, op.cit.]

- 1) Walther Bothe (KWI for Medical Research Heidelberg / Dept. for Physics):  
measurements of nuclear constants (6 physicists)
- 2) Klaus Clusius (Univ. of Munich):  
isotope separation and heavy water production  
(ca. 4 phys.chemists and physicists)
- 3) Kurt Diebner (Army Ordnance Laboratory in Gottow nearby Berlin):  
measurements of nuclear constants (ca. 6 physicists)
- 4) Otto Hahn (KWI for Chemistry Berlin):  
transuranic elements, fission products, isotope separation,  
measurements of nuclear constants (ca 6 chemists and physicists)
- 5) Paul Harteck (Univ. of Hamburg):  
heavy water production and isotope separation (5 phys.chemists, physicists, chemists)
- 6) Werner Heisenberg (Univ. of Leipzig; advisor at the KWI for Physics Berlin):  
uranium machines isotope separation, measurements of nuclear constants  
(ca. 7 physicists and physical chemists)
- 7) Hans Kopfermann (Univ. of Kiel, later Univ. of Göttingen):  
isotope separation (2 physicists)
- 8) Nikolaus Riehl (Oranienburg nearby Berlin; Auer Company):  
uranium production (ca. 3 researchers)
- 9) Georg Stetter (Univ. of Vienna):  
measurements of nuclear constants and transuranic elements  
(ca. 6 physicists and phys.chemists)

Plate 2

Papers, presented at the 2nd scientific meeting of the study group “nuclear physics” (Reich Research Council – Army Ordnance) at February 26th, 1942, 11 o'clock in the “Haus der Deutschen Forschung”, Berlin-Steglitz, Grunewaldstraße 35

[Hahn, Dietrich (Ed.): Otto Hahn – Begründer des Atomzeitalters. List Verlag München 1979, p.171]

- |  |                         |
|--|-------------------------|
| 1. Kernphysik als Waffe  | Prof. Dr. Schumann      |
| 2. Die Spaltung des Urankernes   | Prof. Dr. O. Hahn       |
| 3. Die theoretischen Grundlagen für die Energiegewinnung<br>aus der Uranspaltung   | Prof. Dr. W. Heisenberg |
| 4. Ergebnisse der bisher untersuchten Anordnungen zur<br>Energiegewinnung  | Prof. Dr. W. Bothe      |
| 5. Die Notwendigkeit der allgemeinen Grundlagenforschung   | Prof. Dr. H. Geiger     |
| 6. Anreicherung der Uranisotope  | Prof. Dr. K. Clusius    |
| 7. Die Gewinnung von Schwerem Wasser   | Prof. Dr. P. Harteck    |
| 8. Über die Erweiterung der Arbeitsgemeinschaft „Kernphysik“<br>durch Beteiligung anderer Reichsressorts und der Industrie | Prof. Dr. Esau          |



## Otto Hahn and the Declarations of Mainau and Göttingen\*

*Horst Kant*

The Declarations of Mainau (1955) and Göttingen (1957) played an important role in the anti-atomic-weapons-movement of the 1950s. In addition, the Göttingen Declaration, in particular, is one of the most significant political post-war expressions of opinion made by German (natural) scientists (notably physicists); it is a stance that drew a favourable public response, with its political effects being perceptible still today. Thus the Göttingen Declaration should be considered a trigger for political discussions in Germany in 1957 and 1958 concerning the acquisition of nuclear arms for the West German army and for its ethical and military problems.

However, in the following, it is not my intension to elaborate exclusively on an analysis into the public effects and after-effects of the Declarations; there are already a number of studies available in literature.<sup>1</sup> The majority of deliberations on this subject had shown that the active roles of Werner Heisenberg (1901-1976) and Carl Friedrich von Weizsäcker (\*1912) had been put into the centre of attention, although an important – if not decisive – share was also accorded to Otto Hahn (1879-1968). Hahn's part was something like that of a senior figure amid these actions, not only because of his function as the discoverer – together with Fritz Straßmann (1902-1980) – of the uranium nuclear fission in 1938 but also due to his capacity as the President in the

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\* Slightly revised and enlarged version of a paper presented on the *Second International Symposium on the History of Atomic Projects HISAP'99* in October 1999 in Laxemburg nearby Vienna (the lecture-character is preserved). – This paper mainly uses materials from the estate of Otto Hahn (NL Hahn) in the archives of the Max Planck Society (MPG-A). I thank its director and his colleagues for their kind support.

<sup>1</sup> See i.e. Rese, Alexandra: *Wirkung politischer Stellungnahmen von Wissenschaftlern am Beispiel der Göttinger Erklärung zur atomaren Bewaffnung*. Frankfurt am Main etc. 1999 (= Europäische Hochschulschriften Reihe 3 Band 835). – Metzler, Gabriele: *Macht und Moral. Das Manifest der „Göttinger Achtzehn“*. in: *Rheinischer Merkur* No.44/1997 vom 31.Oktober, p.10. – Stölken-Fitschen, Iiona: *Atombombe und Geistesgeschichte – Eine Studie der fünfziger Jahre aus deutscher Sicht*. Baden-Baden 1995 (= Nomos Universitätsschriften / Kulturwissenschaft Bd.3). – Rupp, Hans Karl: *Außerparlamentarische Opposition in der Ära Adenauer – Der Kampf gegen die Atombewaffnung in den fünfziger Jahren*. Köln 1970. – Görlich, Ina: *Zum ethischen Problem der Atomdiskussion*. Philosophische Dissertation Freiburg 1965. – Kraus, Elisabeth: *Von der Uranspaltung zur Göttinger Erklärung. Otto Hahn, Werner Heisenberg, Carl Friedrich von Weizsäcker und die Verantwortung des Wissenschaftlers*. Würzburg 2001.

1950s of the Max Planck Society and, specifically, due to his active advocacy of these Declarations. Therefore, I would like to throw some light on the role of Otto Hahn in initiating, elaborating and propagating these Declarations.

\* \* \*

Six scientists out of the eighteen German nuclear scientists, who had signed the Göttingen Declaration,<sup>2</sup> handed over to the German public on April 12, 1957, belonged to the group of German nuclear scientists who were arrested in British Farm Hall in 1945 as a result of their top-level involvement in the German Uranium Project during World War II.<sup>3</sup> But the other signatories to the Declaration were also connected with the uranium project in one way or another. Yet, the published Farm Hall recordings had made it unequivocally clear that the widespread myth about the German nuclear scientists that they did not intend at all to build a bomb and should thus be regarded as morally clean had its origin in Farm Hall, which was prompted in those days by the news of the American atomic bombs dropped on Japan. Nevertheless, in all fairness, it has to be admitted that there was a varying degree of motivation among the individual German scientists to build a bomb and that, in the end, they all succumbed to their own myth.<sup>4</sup>

It should also be remembered that at least Otto Hahn, right from the very outset, harboured feelings of guilt when he realized the possible misuse of his discovery of nuclear fission. Therefore already in 1939 he had great misgivings about his engagement in the German Uranium Project and he comforted himself with the prospect of sparing young German scientists from their immediate deployment at the military front and with the naive belief that his own chemical research on fission products would not be immediately linked to the use or misuse of fission energy.<sup>5</sup>

The Farm Hall documents reveal Hahn's profound consternation when he was informed about the dropping of an atomic bomb on Hiroshima<sup>6</sup> and also his repeatedly uttered sincere approach

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<sup>2</sup> The Declaration of Göttinger is published i.e. in: *Physikalische Blätter* 13(1957)5, p.193-194.

<sup>3</sup> See Bernstein, Jeremy: *Hitler's Uranium Club – The secret recordings at Farm Hall*. Woodbury NY 1996. [For the German edition of the Farm Hall papers see Hoffmann, Dieter: *Operation Epsilon. Die Farm-Hall-Protokolle oder Die Angst der Alliierten vor der deutschen Atombombe*. Rowohlt Verlag Berlin 1993].

<sup>4</sup> For some further discussion on the German Uranium Project see the paper *Werner Heisenberg and the German Uranium Project* in the first part of this Preprint.

<sup>5</sup> Hahn's opposition against national-socialism served as another reason to show restraint in his cooperation in the uranium project.

<sup>6</sup> Bernstein, Jeremy: *Hitler's Uranium Club*. Cit.above p.119.

to this subject in the subsequent discussions with colleagues that he felt relieved to know that the Germans were not successful.<sup>7</sup>

Like most scientists of his generation Hahn held the view that it might be possible to make a relatively clear separation between the peaceful and the military uses of scientific results. Altogether, he was fully convinced of the blessings for mankind from science and, in consequence, there was no doubt for him that the peaceful use of atomic energy would constitute one of the crucial future-oriented objectives for mankind. At the end of his Nobel lecture in December 1946 he made a cautious reference to this theme:

“The energy of nuclear physical reactions has been given into men’s hands. Shall it be used for the assistance of free scientific thought, for social improvement and the betterment of the living conditions of mankind? Or will it be misused to destroy what mankind has built up in thousands of years? [...] undoubtedly the scientists of the world will strive towards the first alternative.”<sup>8</sup>

Under the provisions of the Allied Control Law No.25 any applied nuclear research was largely banned in post-war Germany, which included nuclear reactor research, isotope studies and cyclotron construction. This implied all those subjects to which Heisenberg and his co-workers wanted to return. Very early, the scientists around Heisenberg and Weizsäcker were seeking for ways and means to play down this ban, or even to stop it to be any longer in force, and it was Hahn, too, who supported these efforts.<sup>9</sup> Already in December 1949 the Chancellor of the new founded Federal Republic of Germany, Konrad Adenauer (1876-1967; CDU), had conducted a talk with Hahn and Heisenberg on the tasks of a future German research council which also touched upon the question of a still prohibited nuclear research.<sup>10</sup> A query by the nuclear physicist Rudolf Fleischmann (\*1903), which was allegedly prompted by an “unclear” newspaper report, was unmistakably answered by Hahn:

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<sup>7</sup> Ibid. p.134: “[...] I thank God on my bended knees that we did not make the uranium bomb.” – In his diary Hahn noticed under Aug 6th 1945: “[...] Schließlich habe ich das gute Gewissen, daß ich weder bei der Entdeckung noch später die Uranspaltung als Kriegsmittel einsetzen wollte; daß ich ja erst glücklich war, als ich (1939 oder) 1940 hörte, eine Bombe könne erst nach einer laufenden Maschine kommen, und daß Jahre notwendig seien, bis man an eine laufende Maschine denken könne. – Ich freue mich jetzt, daß wir keine Mittel und Wege hatten, eine Bombe zu entwickeln, [...]”. [MPG-A, NL Hahn, Abt.III, Rep.14B, No.421-2 (Tagebuch No.2), p.22].

<sup>8</sup> Hahn, Otto: From the natural transmutations of uranium to its artificial fission. In: Nobel Lectures Chemistry 1942-1962. Elsevier Publ. Comp. Amsterdam etc. 1964, p.64.

<sup>9</sup> The Allied Control Law No.25 was relaxed in 1949 and transformed in 1950 to the Allied High Commission Law No.22, but experimental and applied nuclear research (for instance in connection with a reactor) were permitted until as late as 1955.

<sup>10</sup> Radkau, Joachim: Aufstieg und Krise der deutschen Atomwirtschaft 1945-1975. Reinbek bei Hamburg 1983. – Müller, Wolfgang D.: Geschichte der Kernenergie in der Bundesrepublik Deutschland. Stuttgart 1990. – Eckert, Michael: Kernenergie und Westintegration. Die Zählung des westdeutschen Nuklearnationalismus. In: Vom Marshallplan zur EWG – Die Eingliederung der Bundesrepublik Deutschland in die westliche Welt. Hrsg. von L.Herbst, W.Bührer, H.Sowade (= Quellen und Darstellungen zur Zeitgeschichte. Hrsg. vom Institut für Zeitgeschichte, Band 30). München 1990, pp.313-334.

“Gedacht waren die Bemerkungen natürlich so, dass man – wie es ja allgemein in Deutschland gewünscht wird, versuchen möchte, die sogen. verbotenen Forschungsgebiete etwas aufzulockern.”<sup>11</sup>

The international development of armaments, especially the A- and H-weapons – was observed with great concern by many people in Germany, but conceivably the Germans in the post-war years were primarily engaged with their own reconstruction, with the issue of nuclear weapons being left to the Big Powers. Therefore, the onset of an international protest movement at the beginning of the 1950s did not interest the Germans very much. However, the situation changed at the turn of the year 1954/55. At least three aspects were of special importance at that time. First, in October 1954 the Treaties of Paris were signed<sup>12</sup> which, among other things, enshrined the FRG's membership of NATO and, in consequence, the reconstruction of a federal (West-)German army. On the other hand, the escalation of the cold war and the Korean war had led to a growing anti-atomic-war-movement that had finally reached Germany, too. And ultimately, the designs of the German atomic scientists to be once again capable of conducting nuclear research under “normal conditions” came closer to the point of their implementation, and the German scientists came to realize that their designs would be best served when making clear that they had only an exclusive interest in a “peaceful nuclear research”.

Still in 1953 Hahn held the view – at that time widespread among his German colleagues – that protests and appeals would be of no avail since they manifestly would fly in the face of politics.<sup>13</sup> But only one year later Hahn changed his mind and he noticed in his diary (summerizing under the date “1955. Januar”):

“Durch die unsichere politische Weltlage, die großen Spaltungen auch in Deutschland hervorgerufen, bekomme ich immer wieder Briefe, ‘warum schweigt die Wissenschaft’, nämlich zu der Gefahr eines Atomkrieges.

Ich beschließe deshalb einen irgendwie aufklärenden Artikel über Gefahr, aber auch Zukunftshoffnung der Atomforschung zu schreiben. Ich wähle als Thema das ‘Co 60: Gefahr oder Hoffnung’.[...]”<sup>14</sup>

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<sup>11</sup> Hahn to Fleischmann on 23/12/1949. [MPG-A, NL Hahn, Abt.III, Rep.14A, No.958].

<sup>12</sup> Coming into operation in May 1955.

<sup>13</sup> Hahn to B.Berneis on Nov 27, 1953: “[...] Aber Proteste und Aufrufe nützen doch offenbar nichts; wir alle wissen ja, dass sowohl die Amerikaner wie auch die Russen als Völker keinen Krieg wollen. Die Politik ist offenbar stärker als alle Aufrufe und Proteste.” [MPG-A, NL Hahn, Abt.III, Rep.14A, No.267, p.2]

<sup>14</sup> MPG-A, NL Hahn, Abt.III, Rep.14B, No.421-5, p.37. [The notices in Hahn's diary for the years 1955-1957 (and also for the forgoing years and the years after) are not very regularly, often only summerizing and obviously often written on later days.] – See also Hahn, Otto: *Mein Leben*. München/Zürich 1986 (erw. Neuauflage), p.228. – The Evangelical church, at that time in Germany, was intensely engaged in an exchange of views on the dangers of an atomic war, and in June 1954 there was held a meeting on this subject by Hahn, Heisenberg and v.Weizsäcker together with Bishop Otto Dibelius (1880-1967), Church President Martin Niemöller (1892-1984) and Professor of Theology Helmut Gollwitzer (1908-1993) [see MPG-A, NL Hahn, Abt.III, Rep.14A, No.5327].

Max Born (1882-1970) had written an editorial for the journal “Physikalische Blätter” No. 1/1955 in which he appealed to the German physicists to become finally aware of their responsibilities in the atomic age, as their Anglo-Saxon colleagues had already done so.<sup>15</sup> In this connection he wrote to Hahn:

“Lieber Herr Hahn,

Sie haben vielleicht gesehen, daß ich (auf Einladung der Herausgeber) ein paar Zeilen ‘Zum Jahresbeginn’ für die Physik.Blätter geschrieben habe. [...]

Bertrand Russell hat neulich einen kurzen Vortrag ‘Man's Peril from the Hydrogen Bomb’ im BBC gehalten, [...]. Ich bin darauf in Briefwechsel mit ihm getreten und habe vorgeschlagen, daß eine Reihe von leitenden Naturforschern (und andern Gelehrten), etwa lauter Nobelpreis-Träger, eine Warnung publizieren sollte. Er ist darauf eingegangen und hat mir Ratschläge erteilt. [...]

Sie werden natürlich sagen, was nützt das alles? Die Politiker sind doch nicht zu beeinflussen, und wir haben besseres zu tun. Aber ich glaube, wir sollten doch nicht einfach untätig zusehen, wenn man sozusagen den Untergang der Zivilisation vorbereitet, und zwar mit Hilfe der Kräfte, die die Physik zur Verfügung gestellt hat. [...]”<sup>16</sup>

Hahn responded to him:

“Sie haben recht in Ihrer Beurteilung über die Weltlage, die ja im Augenblick sehr wenig erfreulich ist. Auch ich mache mir seit längerer Zeit Sorgen, ob und was man als Wissenschaftler tun könnte. [...] Ich habe nun schon vor etwa 10 Tagen, bevor ich Ihren Brief hatte, den Entwurf zu einem Artikel gemacht. [...]”<sup>17</sup>

Moreover, Hahn like the majority of the scientists, was afraid of being reproached for interfering in politics even at the side of the government opposition. Therefore in the same letter he wrote:

“[...] Damit will ich nicht sagen, dass sie [die deutschen Nobelpreisträger – H.K.] einen Atomkrieg befürworten; sie lehnen ihn genauso ab wie wir, fürchten aber vielleicht, sich zu sehr in die Politik einzumischen.

Dies ist auch der Hauptgrund, warum ich nicht irgendwie vor anderen herausgehoben werden möchte. Es ist mir unmöglich, in meinem Alter neben meiner Tätigkeit in der Max-Planck-Gesellschaft noch quasi in die Politik einzusteigen.”<sup>18</sup>

A few days later it became known that Adenauer had asked Heisenberg that he should not speak about nuclear questions in public prior to the ratification of the Paris Treaties.<sup>19</sup> It was not only

<sup>15</sup> Born, Max: Zum Jahresbeginn. *Physikalische Blätter* 11(1955)1, p.1-2.

<sup>16</sup> Born to Hahn on Febr 1st, 1955 [MPG-A, NL Hahn, Abt.III, Rep.14A, No.386, p.11 + 12]

<sup>17</sup> Hahn to Born on Febr 5th, 1955 [MPG-A, NL Hahn, Abt.III, Rep.14A, No.386, p.15].

<sup>18</sup> Ibid.

<sup>19</sup> Heisenberg since 1952 was the chairman of the commission for atomic physics within the German Research Council, and in this function also acted as an adviser in nuclear questions for the chancellor. Probably Heisenberg wanted to speak about the coming development of German nuclear reactors. – For a discussion of the role

the scientists who had interpreted this request as an interference in the realm of scientific freedom of speech.<sup>20</sup> This gave rise to Hahn to bring his Cobalt-60-paper before the public. At the suggestion of Hinrich Kopf (1893-1961; SPD), Prime Minister of the State Lower Saxony, Hahn gave this lecture on February 13, 1955, at the broadcasting station of the Northwest German radio.<sup>21</sup> The days before the scientists had, understandably, diverging views on the effects caused by such a public performance. Hahn, in his notebook, wrote on February 12:

“Weizsäcker fürchtet die Panik der Bevölkerung, ich halte Aufklärung für gut.”<sup>22</sup>

In his lecture Hahn in a popular style explained the dangerous effects as well as the peaceful possibilities of using Cobalt 60. I only quote here the last sentences, which are of interest for the further context:

“Die meisten Länder sind gar nicht in der Lage noch beabsichtigen sie, Atombomben oder Wasserstoffbomben herzustellen; Deutschland ganz bestimmt nicht. Aber sie sind in der Lage und wünschen es, sich an den friedlichen Möglichkeiten der Atomspaltung zu beteiligen.

Einem vereinten Appell aller verantwortungsbewußten Wissenschaftler, denen die Gefahren der Anwendung eines die Welt bedrohenden Kriegsmittels bekannt sind, sollte es

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of Heisenberg in Germany's post-war nuclear politics see i.e. Carson, Cathryn: New models for science in politics: Heisenberg in West Germany. *Historical Studies in the Physical and Biological Sciences* 30(1999)1, pp.115-171.

<sup>20</sup> See Gerlach, Walther and Dietrich Hahn: *Otto Hahn – Ein Forscherleben unserer Zeit*. Stuttgart 1984, p.131.

<sup>21</sup> In Hahn's diary we read on this situation: “[...] erreicht mich am 30. Jan. am Sonntag ein Anruf des Min[nister]Präsid[enten] Kopf aus Hannover mit der Bitte, mich aufzusuchen. Am Sonntag Nachm[ittag] kommt er zu uns in die Wohnung. Er fragt mich: ist die deutsche Forschung oder sind die deutschen Forscher noch frei zu sagen, was sie meinen. Ich bejahe dies. Er zeigt mir Brief von Heisenberg an Dr. Jürgen Eggebrecht vom N.W.D.R., in dem Heisenberg schreibt, daß er auf Bitte Adenauers einen verabredeten Radiovortrag über Atomenergie aufschieben möchte bis nach Unterzeichnung der ‘Pariser Verträge’. Ich sage, dabei handle es sich wohl um eine Darstellung des seit langem geplanten deutschen Kernreaktors, von dem aber, weil wir ja bisher noch in der Herstellung eines Kernreaktors nicht frei seien, vor den Verträgen besser nicht zu sprechen sei. Kopf faßt die Adenauer-Bitte offenbar anders auf: Will Adenauer eine Aufklärung des deutschen Volkes über die Gefahr eines Atomkrieges im Unklaren lassen, weil er damit vielleicht die von A. befürwortete Wiederausrüstung und die damit vergrößerte Gefahr eines Krieges gestört sehe.

Ich halte diese Interpretation von Kopf nicht für zutreffend, kann aber natürlich nichts sicheres sagen, weil ich nicht weiß, über was Heisenberg vortragen wollte.

[...] Bei dieser Gelegenheit erzähle ich Kopf von meinem geplanten und schon niedergeschriebenen Artikel über Co 60. Ich biete ihm an, oder er bittet mich, den Artikel zu lesen; [...] damit er sähe, daß wir keine Hemmungen haben, über die Gefahren der Atombomben zu sprechen. [...]

8.II. Gleich am Vormittag danach Anruf vom N.W.D.R. Hannover, ob ein Aufnahmewagen kommen könne, meinen Vortrag auf Band sprechen zu lassen. Ich wunderte mich über die Eile. [...]

13.II. Der Vortrag wurde dann am Sonntag von 18 - 18.20 gesendet, nachdem der vorher für diese Zeit vorgesehene Vortrag eines bekannten Professors um 4 Wochen verschoben wurde. [...] Gleichzeitig mit dem N.W.D.R. wurde nach Dänemark, Norwegen und Österreich gesendet. Am Montag kam Anruf aus Hannover, auch der britische B.B.C. möchte den Vortrag bringen. Sie wollen ihn übersetzen, ich soll ihn dann englisch verlesen. Ich stimme zu.” [MPG-A, NL Hahn, Abt.III, Rep.14B, No.421-5, p.37-39].

<sup>22</sup> Cit. after Hahn, Dietrich: *Otto Hahn – Begründer des Atomzeitalters*. München 1979, p.247. – Hahn's notebook [Notizbuch] and his diary [Tagebuch] are two different (pocket-)books.

doch gelingen, die Verantwortlichen der großen Politik auf beiden Seiten des Eisernen Vorhangs an einen Verhandlungstisch zu bringen.

Heute ist der Krieg nicht mehr ‘die Fortsetzung der Politik mit anderen Mitteln’. In einem Bombenkrieg gibt es nicht mehr Sieger und Besiegte. Die großen Bomben zerstören in einem Augenblick die Stätten der Zivilisation. Die tödlichen Strahlungen tun dann ihr Vernichtungswerk langsamer, aber umfassend. Sollten nicht die vielen Möglichkeiten für Frieden und Wohlstand der Völker den Sieg davortragen können, wenn die Menschen wirklich erfahren, um was es geht?”<sup>23</sup>

The public reaction – even abroad – was impressive.<sup>24</sup> Hahn, in a more unequivocal and convincing manner than others, had pointed at the dangers of a misuse of atomic energy.<sup>25</sup> Born for instance yet on the evening of February 13 wrote to Hahn:

“Ich habe eben Ihren Vortrag am NWDR gehört, sehr schön und eindrucksvoll. Ich bin mit allem einverstanden. Nur denke ich mir, daß der Appell, den Sie erwähnen oder vorschlagen, wirklich ausgeführt werden sollte als ein ‘Massenangriff’ einer großen Zahl führender Physiker, Chemiker, Physiologen etc. Ich grüble viel über die Formulierung, aber ich habe noch nichts rechtes.”<sup>26</sup>

Now it seemed appropriate for Hahn to make use of the positive effects caused by his Cobalt-60-paper and possibly to try to influence political decision-making processes against atomic weapons. On the other hand, Hahn was not willing to join the activities of those shown by Bertrand Russell (1872-1970) or by the World Federation of Scientific Workers under Frédéric Joliot-Curie (1900-1958) for fear of being shifted into the vicinity of Communists or Russians respectively – and being in fear of communism was one of the most powerful political batons in the 1950s West-Germany.

Thus Hahn, as the result of an exchange of views with Born, Heisenberg and Weizsäcker, and others arrived at the solution to his problems, namely, to elevate the annual meeting of Nobel Laureates in Lindau to a forum from which an appeal should be launched for the peaceful, not military, use of nuclear energy.<sup>27</sup> The first version of an adequate appeal was formulated by

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<sup>23</sup> Hahn, Otto: Cobalt 60 – Gefahr oder Segen für die Menschheit. Göttingen etc. 1955. Republished i.e. in O.Hahn: Mein Leben. Piper Verlag München/Zürich 1986, pp.268-276. – With respect to different versions of the manuscript see MPG-A, NL Hahn, Abt.III, Rep.14A, No.6138.

<sup>24</sup> “Febr. + März 55. Im Laufe dieser Monate bekomme ich sehr viele Briefe und Aufforderungen zur Veröffentlichung. [...] Im allgemeinen ist die Resonanz besonders groß bei links gerichteten Stellen. Selbst der Ministerpräsident Grotewohl der Ostzone bezieht sich auf ihn in einem seiner ‘Friedensappelle’. [...]” [MPG-A, NL Hahn, Abt.III, Rep.14B, No.421-5, p.39].

<sup>25</sup> Hahn, Otto: Cobalt 60 – Gefahr oder Segen für die Menschheit. Göttingen etc. 1955.

<sup>26</sup> Born to Hahn on Febr 13, 1955 [MPG-A, NL Hahn, Abt.III, Rep.14A, No.386, p.16].

<sup>27</sup> The Lindau meetings were organised since 1951, and the meeting for 1955 was planned for July 11-15. – Hahn was a regular participant of these meetings and a member of the organizing committee. He hoped, that the intended exclusiveness – by inviting only scientific Nobel laureates to sign – would give more political emphasis and at the same time could be a reinsurance against communist influences; therefore F.Joliot-Curie and C.F.Powell were not included in the circle of possible first-signatories. [See i.e. Born to Russell; MPG-A, NL Hahn, Abt.III, Rep.14A, No.386, p.28]

Born, whereas the final version was the work of Weizsäcker following the discussions with the remaining three scientists.<sup>28</sup> But Weizsäcker, for personal reasons, preferred to remain in the background.<sup>29</sup> Hahn and Born were trying to win fellow combatants and associates from other countries, while Hahn was busy settling the situation in Lindau. Hahn was successful in winning Count Lennart Bernadotte (\*1909), patron of the Lindau meetings, for supporting his plan, and Bernadotte himself suggested to proclaim the Declaration on his isle of Mainau within Lake Constance.<sup>30</sup> An intended idea was to exclude the public as far as possible in the preliminary stages from participation.<sup>31</sup> In this connection Born wrote to Hahn:

“[...] Ich glaube nun in der Tat, daß es (1) nichts schadet, wenn wir bei Russell mit unterzeichnen (Ich werde es jedenfalls tun, da er und Einstein mir eine Weigerung sehr verübeln würden); daß es (2) nicht viel schaden kann, wenn er unser Manifest kennt, nur darf er es keinesfalls den andern Mitgliedern seiner Gruppe (Powell, Bernal etc.) zeigen. [...] Ich glaube, daß wir uns in der Sache auf Russell verlassen können. [...]”<sup>32</sup>

Another point was that the text should not be changed by discussions in Lindau; with respect to this Weizsäcker wrote to Born:

“[...] Es schien insbesondere Hahn, aber auch mir, daß man in Lindau keine große Diskussion mehr haben darf. Genauer gesagt, eine Diskussion darf man schon haben, aber man muß ziemlich fest entschlossen sein, zum Schluß doch im wesentlichen den Text zu veröffentlichen, den man schon mitgebracht hat. Große Gremien sind erfahrungsgemäß nicht imstande, einen durchdachten Text zu formulieren. [...]”<sup>33</sup>

The reactions of the invited Nobelprize-winner-colleagues were different. Niels Bohr (1885-1962) and Artturi Virtanen (1895-1973) declined to take part for various reasons,<sup>34</sup> whereas

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<sup>28</sup> Hahn notices: “[...] v. Weizsäcker macht wohl die besten Vorschläge. Gewisse Teile von Heisenberg gehen mir zu weit, der Benecke’sche ist vielleicht zu populär.” [MPG-A, NL Hahn, Abt. III, Rep. 14B, No. 421-5, p. 40]. – Dr. Otto Benecke (1896-1964) 1951-1961 was General Secretary of the MPG (in addition to Ernst Telschow).

<sup>29</sup> MPG-A, NL Hahn, Abt. III, Rep. 14A, No. 4652 (added handwritten notice by von Weizsäcker to a letter dated 2/4/1955: “[...] mich in diesen Zusammenhängen möglichst nie zu nennen. Sonst werde ich kaum mehr meine Ruhe für die Arbeit retten, an der mir viel liegt.”) – One reason for this reservation certainly was the fact that he officially retired from physics at that time and prepared himself to take over a chair in philosophy (which he realised in 1957).

<sup>30</sup> Hahn to Born on 28/3/1955: “[...] Er war sehr angetan von unserer Aktion, und wir kamen zu dem Ergebnis, dass anstelle eines Lindauer Manifests ein ‘Mainauer Manifest’ noch wirkungsvoller sei. [...]” [MPG-A, NL Hahn, Abt. III, Rep. 14A, No. 386, p. 21].

<sup>31</sup> See MPG-A, NL Hahn, Abt. III, Rep. 14A, No. 386, No. 4652.

<sup>32</sup> Born to Hahn on 14/4/1955 [MPG-A, NL Hahn, Abt. III, Rep. 14A, No. 386, p. 30/31]

<sup>33</sup> Weizsäcker to Born on 20/5/1955 [MPG-A, NL Hahn, Abt. III, Rep. 14A, No. 386, p. 45]

<sup>34</sup> Born to Hahn on 25/4/1955: “[...] Nun hat auch Bohr abgelehnt; [...]” [MPG-A, NL Hahn, Abt. III, Rep. 14A, No. 386, p. 35]. – For a background-discussion for the reasons of Bohr’s refusal see i.e. Aaserud, Finn: The scientist and the statesmen: Niels Bohr’s political crusade during World War II. *Historical Studies in the Physical and Biological Sciences* 30(1999)1, pp. 1-47.

Hideki Yukawa (1907-1981) “enthusiastically” accepted the invitation.<sup>35</sup> Weizsäcker in a letter to Hahn noted on April 4th, 1955:

“[...] Meinem Gefühl nach ist der Sinn Ihres Aufrufs dadurch nicht gefährdet, dass ein Teil der Angesprochenen aus achtbaren Gründen nicht mitmacht.”<sup>36</sup>

Rather, there was the obvious apprehension of no longer being able to attract sufficient attention in a parallel contest with other activities, so that Weizsäcker wrote the following in the same letter:

“Ich fürchte immer noch, die Lindauer Sache könnte nach mehreren anderen ähnlichen Unternehmungen zu spät kommen, um noch besonderen Eindruck zu machen.”<sup>37</sup>

The Russell-Einstein-Manifesto was then handed over to the press in London on July 9, 1955 (plate 1).<sup>38</sup> Max Born was the only German signatory. Hahn wrote the following in his notebook under July 12th:

“Der Russell-Aufruf in den Zeitungen bringt etwa den Inhalt unseres Manifestes. Aber wegen der einseitig linken Tendenz hatte ich Russell abgelehnt zu unterschreiben.”<sup>39</sup>

Notwithstanding, Hahn succeeded in making all 16 Nobel-prize-winners attending the meeting in Lindau to sign his appeal.<sup>40</sup> Per date of July 15 it was handed over to the press during a meeting on the isle Mainau as the Declaration of Mainau.<sup>41</sup> Among the signatories (plate 2) were also Born and Yukawa, who had already signed the Russell-Einstein-Manifesto. Among the German Nobel-prize-winners there were – apart from Born – the names of Adolf Butenandt (1903-1995), Otto Hahn and Werner Heisenberg.<sup>42</sup> Later on the document was sent to all scientific Nobelprize-winners and one year later<sup>43</sup> there were 51 signatures to be found (among

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<sup>35</sup> Born to Hahn on 21/4/1955: “Yukawa hat begeistert zugestimmt [...]” [MPG-A, NL Hahn, Abt.III, Rep.14A, No.386, p.33].

<sup>36</sup> Weizsäcker to Hahn on 21/4/1955 [MPG-A, NL Hahn, Abt.III, Rep.14A, No.4652].

<sup>37</sup> Ibid.

<sup>38</sup> Published i.e. in: *Physikalische Blätter* 11(1955)9, pp.392-394.

<sup>39</sup> Cit. after Hahn, Dietrich (1979); cit.above, p.249.

<sup>40</sup> See Hahn, Otto: *Mein Leben*. Cit.above, p.230. – In his notebook Hahn wrote under the date of 11/7/55: “Nachmittags noch längere Besprechungen mit den anwesenden 16 Nobelpreisträgern. Schließlich gibt auch Lipmann nach.” [cit. after Hahn, Dietrich (1979), cit.above, p.249]

<sup>41</sup> Published i.e. in Hahn, Otto: *Erlebnisse und Erkenntnisse*. Ed. by Dietrich Hahn, Düsseldorf etc. 1975, pp.217-219. – Herneck, Friedrich: *Bahnbrecher des Atomzeitalters*. Berlin 1984, pp.9-10.

<sup>42</sup> Soon after Walter Bothe (1891-1957) and Max von Laue signed it; Gustav Hertz (1887-1975) from Leipzig (GDR) added his signature in November 1955. – One reason for Hahn not to invite other German scientific Nobelprize-winners in the first attempt was, not to have a preponderance of German signatures.

<sup>43</sup> While the Lindau meeting of 1955 had its main point in chemistry, that of 1956 was physics. During the 1956-meeting the matter of the Declaration was confirmed again. – And in 1956 Hahn did his best to invite also Joliot-Curie! [MPG-A, NL Hahn, Abt.III, Rep.14A, No.5957, p.19]. – Furthermore it may be recorded, that all announced speakers of that year – Laue, Cockcroft, Hertz, Heisenberg, Yukawa, Dirac, Zernike, Born, Raman and Blackett – were also signatories of the Declaration of Mainau. [see MPG-A, NL Hahn, Abt.III, Rep.14A, No.5957, p.22].

them also Paul Dirac (1902-1984), James Franck (1882-1964), Frédéric und Irène Joliot-Curie, Wolfgang Pauli (1900-1958), Linus Pauling (1901-1994) und Bertrand Russell).<sup>44</sup>

One week after the Lindau meeting of 1955 the four victorious powers convenet in Geneva for the summit conference that was to initiate the policy of détente and from August 8 to 20, 1955 the first U.N.-Conference “Atoms for Peace” was held in Geneva.<sup>45</sup> Otto Hahn was the head of the German delegation. The German scientists with great contentment took note of the excellent international reputation enjoyed by them at this conference through the person of Hahn.<sup>46</sup> However, it was also found out that the reaction to the Declaration of Mainau remained fairly low. Probably one reason lies in Russell’s better prepared press campaign, while the group around Hahn believed in the self-acting of the Mainau Declaration; another reason was, that up until autumn 1955 the Declaration wasn’t yet send off to all potential participants.<sup>47</sup>

The meeting of members of the *Verband der Deutschen Physikalischen Gesellschaften e.V.* on Sept 25th, 1955 in Wiesbaden accepted a resolution, which referred as well to the Russell-Einstein-Manifesto as to the Mainau Declaration:

“Wir [...] haben die von Bertrand Russell und neun<sup>[48]</sup> anderen führenden Naturwissenschaftlern aus aller Welt unterzeichnete Resolution und den Mainauer Appell von 18 dort versammelten Nobelpreisträgern zu Atomrüstung und Atomkrieg mit tiefer Befriedigung und voller Zustimmung zur Kenntnis genommen. [...]

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<sup>44</sup> See MPG-A, NL Hahn, Abt.III, Rep.14A, No.5956 + 5957. – The full list of signatures contains: Edgar D.A. Adrian (Cambridge), Kurt Alder (Köln), Max Born (Bad Pyrmont), Walter Bothe (Heidelberg), Percy W.Bridgman (Cambridge), Adolf Butenandt (Tübingen), Arthur H. Compton (Saint Louis), Henrik Dam (Kopenhagen), Clinton J. Davisson (Charlottesville), Paul A.M. Dirac (Oxford), Edward A. Doisy (Saint Louis), Gerhard Domagk (Wuppertal), Joseph Erlanger (Saint Louis), Hans K. von Euler-Chelpin (Stockholm), James Franck (Chicago), Otto Hahn (Göttingen), Werner Heisenberg (Göttingen), P.S.Hench (Rochester), Gustav Hertz (Leipzig), Georg von Hevesy (Stockholm), Corneille Heymans (Gent), Frédéric Joliot-Curie (Paris), Irène Joiliot-Curie (Paris), Edward Kendall (Princeton), Hans Krebs (Oxford), Richard Kuhn (Heidelberg), Max von Laue (Berlin), Fritz Lipmann (Boston), Egas Moniz (Lissabon), Paul H. Müller (Basel), Hermann J. Muller (Bloomington), William Murphy (Boston), Wolfgang Pauli (Zürich), Kinus Pauling (Pasadena), Cecil F. Powell (Bristol), Chandrasekhara Raman (Bangalore), Tadeus Reichstein (Basel), Bertrand Russell (Richmond), Leopold Ruzicka (Zürich), Frans Sillanpää (Helsinki), Frederick Soddy (Brighton), Wendell M. Stanley (Berkeley), Hermann Staudinger (Freiburg), Richard L.M. Synge (Bucksburn), Max Theiler (New York), Arne Tiselius (Uppsala), Harold C. Urey (Chicago), George H. Whipple (Rochester), Heinrich Wieland (Starnberg), Adolf Windaus (Göttingen), Hideki Yukawa (Kyoto), Frits Zernike (Groningen).

<sup>45</sup> In an evening lecture on this conference Bohr made clear his position to this subject. [Bohr, Niels: *Physical Science and Man’s Position*. In: Niels Bohr *Collected Works* Vol.10. Amsterdam etc. 1999, pp.99-106]. – See also Röseberg, Ulrich: *Niels Bohr. Leben und Werk eines Atomphysikers*. Berlin 1985, p.293.

<sup>46</sup> See i.e. Arendt, P.R.: *Einige Ergebnisse von der Internationalen Konferenz für friedliche Anwendung der Atomenergie*. *Physikalische Blätter* 11(1955)11, p.507.

<sup>47</sup> Hahn to Born on 17/9/1955 [MPG-A, NL Hahn, Abt.III, Rep.14A, No.386, p.64, also 70, 73].

<sup>48</sup> Astonishingly Born was not mentioned as an signatory of the Russell-Einstein-Manifesto in most German publications on this subject (see i.e. *Physikalische Blätter* 11(1955)9, pp.392-394).

Die Physiker, die ihre Forschungsergebnisse in den Dienst der Menschheit stellen, fühlen sich verpflichtet, vor jeglichem Mißbrauch dieser Ergebnisse nachdrücklich zu warnen.”<sup>49</sup>

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But specifically in Germany, that was anxious as a new NATO-partner to join the alliance military on a par with the others, the governmental policies seemed to disregard the warnings about atomic weapons and, instead, appeared to be striving to acquire such weapons. Thus in a letter dated 19/11/1956, fourteen physicists, most of them members of the so-called Atomic Commission (plate 3) – among them Hahn, Heisenberg and Weizsäcker – addressed themselves to the Minister of Defence, Franz Joseph Strauss (1915-1988; CSU):

“Manche Pressemeldungen der letzten Monate lassen die Deutung zu, die Bundesregierung erwäge ernstlich die Ausrüstung der Bundeswehr mit Atomwaffen. Wir, die Unterzeichneten, haben in privaten Gesprächen festgestellt, daß jeder einzelne von uns über diesen Gedanken tief beunruhigt ist, da wir bisher den Verzicht der Bundesregierung auf Atomwaffen für endgültig gehalten hatten.”<sup>50</sup>

Following a meeting between the Minister of Defense and the scientists in January 1957 the scientists agreed on the understanding that the misgivings indicated should not be released to the public for the moment.<sup>51</sup> But explanations made by the Chancellor before the press on April 5th, 1957, on the planned nuclear equipment of the German army and on the ensuing equal treatment of tactical atomic weapons with conventional ones served as a signal for the scientists to elucidate the public at large on the imminent dangers of atomic weapons.

Obviously it was Walther Gerlach (1889-1979) who, as the first one, took note of Adenauer’s comments from the media on April 6, and it was he who informed Weizsäcker about it. And it was again Weizsäcker who after consultations with Hahn and Heisenberg took finally the initiative.<sup>52</sup> While Weizsäcker formulated the draft of the Göttingen Appeal,<sup>53</sup> it was Hahn who

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<sup>49</sup> Entschließung der deutschen Physiker [...]. *Physikalische Blätter* 11(1955)10, p.441.

<sup>50</sup> MPG-A, NL Hahn, Abt.III, Rep.14A, No.6500, p.3.

<sup>51</sup> See H.-K.Rupp: *Ausserparlamentarische Opposition* [...] (1970); cit.above, p.77. – A.Rese: *Wirkung politischer Stellungnahmen* [...] (1999); cit.above, p.49f.

<sup>52</sup> Annotation of Gerlach (13/3/1975) concerning the prehistory of the declaration of Göttingen [MPG-A, NL Hahn, Abt.III, Rep.14A, No.6509, p.5]. – Hahn to Born on 8/4/57: “Gerade ist Professor v.Weizsäcker bei mir und hat den Entwurf einer Erklärung vorgelesen, die sich mit der Verwendung der Atomwaffen befasst. Wir haben ja vor einigen Tagen auch über dieses Problem gesprochen, und ich habe den Eindruck, dass Sie gern bereit sind, diese Erklärung zu unterschreiben.” [MPG-A, NL Hahn, Abt.III, Rep.14A, No.388, p.2].

<sup>53</sup> In 1997 v.Weizsäcker remembered: “Der Text ist von – ich würde sagen – drei bis vier oder fünf Leuten in gewisser Weise in gemeinsamer Verantwortung gemacht worden. Aber ich war wohl derjenige, der den Hauptteil, auch die Disposition des Ganzen formuliert hat.” [Lindner, Konrad: *Der bedrohte Frieden. Carl Friedrich von Weizsäcker und die Verantwortung der Wissenschaft. Produktion Sender Freies Berlin vom 27.11.1997; [http://www.radiobremen.de/rb2\\_archiv/wissenschaft/1997/w71127.htm](http://www.radiobremen.de/rb2_archiv/wissenschaft/1997/w71127.htm)].*

established mainly the contacts with the majority of the signatories (finally there were 18 signatures – see plate 4). Thus he wrote to his former co-worker Fritz Strassmann:

“Lieber Herr Strassmann!

In den vergangenen Monaten hat der Arbeitskreis ‘Kernphysik’ der Atomkommission Schritte bei den beiden Bundesministern für Verteidigung und für Atomfragen unternommen, deren Tendenz aus der Erklärung hervorgeht, die diesem Brief beiliegt.

Ein Brief, wie er damals geschrieben wurde, wurde auf Wunsch des Ministers Strauß nicht veröffentlicht. Es scheint aber jetzt uns Göttingern im Einklang mit den Herren Walther Gerlach und Max Born, die uns zu diesem Schritt noch ermutigt haben, dass wir doch öffentlich etwas zu dieser Sache sagen sollten.

Heisenberg, Weizsäcker, Gerlach, Born und ich werden voraussichtlich gegen Ende dieser Woche den beiliegenden Text mit unserem Namen der Presse übergeben. Wir fragen die Mitglieder des Arbeitskreises ‘Kernphysik’ sowie die Herren v.Laue, Paul und Fleischmann, ob sie sich daran beteiligen wollen und wenden uns mit derselben Frage an Sie.

Wenn es Ihnen recht ist, dass auch ihr Name unter dieser Erklärung steht, spätestens müssten wir dies bis zum Freitag, d.12.April wissen. [...]”<sup>54</sup>

The pivotal aspects of the Göttingen Declaration were that the signatories had stood up against nuclear armament of the Federal German Army, that they brought home to the public the dangers of atomic weapons and that they solemnly disavowed their participation in the manufacture and testing of atomic weapons. At the same time they declared their willingness to stand up for research into the peaceful utilization of atomic energy. This declaration was exclusively addressed to the Federal Government and therefore did not lay claim to an international dimension and, expressly, did not raise any objections to atomic-bomb-testing.<sup>55</sup>

Strassmann answered to Hahn the next day:

“[...] Den Satz, dass ich in keiner Weise und unter keinen Umständen bereit bin, mich an der Herstellung, der Erprobung oder dem Einsatz von Atomwaffen zu beteiligen, dagegen die Ausnutzung der Kernenergie mit allen Kräften fördern werde, kann ich selbstverständlich bedenkenlos unterschreiben. [...]”

Ich glaube nicht, dass die Betonung, dass wir uns zur Freiheit bekennen, wie sie die westliche Welt gegen den Kommunismus vertritt eine Spur von Verhandlungswillen erkennen lässt. Es scheint mir eine dem heutigen parlamentarischen Stil angepasste Ausdrucksweise zu sein, die zu nichts verpflichtet und alle Möglichkeiten offen lässt. Wenn

<sup>54</sup> Hahn to Strassmann on 9/4/1957 (express and by registered mail) [MPG-A, NL Hahn, Abt.III, Rep.14A, No.6501, p.1].

<sup>55</sup> Hahn for instance in a letter to Karl Bechert (1901-1981) on 12/12/1957 accentuated this aspect explicitly [MPG-A, NL Hahn, Abt.III, Rep.14A, No.208, p.2].

die führenden Wissenschaftler sich wirklich nicht berechtigt fühlen konkrete Vorschläge für die Politik zu machen, dann sollte man aus einer von menschlicher und wissenschaftlicher Verantwortung diktierten Erklärung alle politischen Formulierungen streichen [...]”<sup>56</sup> As is generally known, the Declaration was delivered to the press in the morning of Friday April 12, 1957, and distributed by dpa (German Press Agency) in the afternoon; as a consequence it was published in the newspapers only on Saturday – that means one week after Adenauer’s press release on atomic weapons (and one week before Easter). Obviously it was Hahn’s tactical consideration to let the Declaration make impression on the reader during weekend, before the government, surprised by this action, could argue against it.<sup>57</sup> One reaction of the Federal Government was to summon a delegation of the 18 signatories to a discussion with members of the government; interesting to notice that in this circle on the part of the government participated besides Adenauer himself Strauss as the Minister of Defence, but not the so-called “Atomminister” [Minister for Nuclear Energy] Siegfried Balke (1902-1984; CSU).<sup>58</sup> Among the scientists were Hahn and v.Weizsäcker, but not Heisenberg.<sup>59</sup> In a concluding communiqué the scientists more or less could hold their ground.<sup>60</sup> Nearly by all participants has come down that Strauss was indignant about the behavior of the scientists.<sup>61</sup> Adenauer on the same evening reported to the Federal President Theodor Heuss (1884-1963):

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<sup>56</sup> Strassmann to Hahn on 10/4/1957 [MPG-A, NL Hahn, Abt.III, Rep.14A, No.6501, p.4].

<sup>57</sup> See A.Rese (1999), cit.above p.60. – Dated April 12, 1957, Hahn had sent a copy of the Declaration to minister Strauss. In the covering letter Hahn appointed: “[...] Wir fürchten, dass Sie mit dieser Erklärung nicht einverstanden sind, aber wir glauben doch, für die weitere Zukunft etwas zur Aufrechterhaltung des Friedens mit einer solchen Erklärung beitragen zu können.” [MPG-A, NL Hahn, Abt.III, Rep.14A, No.6500, p.7].

<sup>58</sup> The group of scientists was constituted by Gerlach, Hahn, v.Laue, Riezler and v.Weizsäcker; on the part of the government were Adenauer, Globke (Staatssekretär im Kanzleramt), Hallstein (auswärtiges Amt), Strauß (Verteidigungsminister), Kilb (pers.Referent des Bundeskanzlers), v.Eckardt (Bundespressechef), Hasenlein (Kanzleibeamter) and the generals Heusinger und Speidel.

<sup>59</sup> Heisenberg was invited too, but had declined for health reasons. In fact he was rather ill in February/March 1957 and had to take care of himself [see i.e. Heisenberg, Elisabeth: Das politische Leben eines Unpolitischen. München/Zürich 1991, p.171f]. But Hahn and others believed, that this was only half-truth. Hahn noticed in his diary under April 15th, 1957: “[...] Aber Heisenberg zögert sehr. [...] Heisenberg selbst ist in diesen Tagen nervös und erregt, denn in irgend einer süddeutschen Nachricht habe gestanden, er sei Sozialdemokrat, möchte in den Bundestag und ev. später Atomminister werden. Diesen Unsinn dementiert Heisenberg. Eine ungeschickte Äusserung, die er über seine Beteiligung an unserem Aufruf schreiben wollte – er hätte ihn zur Unterschrift bekommen und unterschrieben, ohne sich irgendwie damit befaßt zu haben – kann ich abbiegen vorher. [...]” [MPG-A, NL Hahn, Abt.III, Rep.14B, No.421-6 (Tagebuch No.6), p.7-8]. – In his autobiography Hahn formulates a little bit more moderate [Hahn, Otto: Mein Leben. Cit.above p. 234-236].

<sup>60</sup> The Communiqué is published i.e. in: Otto Hahn, Begründer des Atomzeitalters. Ed. by Dietrich Hahn, München 1979, p.280. – See also: Dokumente zum Göttinger Manifest. Schriftenreihe des „Fränkischen Kreises“ H.1957/1, p.17.

<sup>61</sup> In his diary Hahn later noticed under April 12th: “[...] Schon am Nachmittag kommt Anruf von Min. Strauß, der sehr aufgebracht ist [...]” And under the 17th: “[...] Strauß ist ziemlich böse, [...]” [MPG-A, NL Hahn, Abt.III, Rep.14B, No.421-6, p.7, 9]. – In his memories Strauss does not mention neither this meeting nor the Declaration of Göttingen at all, he only mentions by the way and disparagingly that “Anti-Atomtod-Kampagne”, which took place in all NATO-states [Strauß, F.J.: Die Erinnerungen. Berlin 1989, p.320f].

“[...] der Aufstand der Atomwissenschaftler, der für mich ganz überraschend kam – Herr Strauß hatte mir nach einer Aussprache mit Herrn Hahn gesagt, die Herren würden nichts tun –, war innen- und außenpolitisch sehr unangenehm. Nach einer vielstündigen Aussprache, die heute mit fünf der Herren stattfand, scheint die Angelegenheit in einer für beide Teile zufriedenstellenden Weise erledigt zu sein.”<sup>62</sup>

Several special points would be worthy of further study into the background and, specifically, the effects of the Göttingen Declaration on the public.<sup>63</sup> Brief reference shall be made here only to several further activities of Hahn.

But previously a short judgement of the meeting with Adenauer by Max von Laue (1879-1960), written on April 23rd, 1957 (Tuesday after Easter) to Hahn, shall be mentioned:

“[...] Hoffentlich ist Dir die ‘Flucht aus Bonn’ ebenso gut gelungen, wie mir. [...] Ich habe selbstverständlich noch oft über das Erlebnis nachgedacht und bin mit unserer Haltung und dem Ausgang des Abenteuers eigentlich recht zufrieden. Die Pflicht der Vaterlandsverteidigung, die man in unserer Jugend durchaus anerkennen mußte, hört auf, wenn die Anwendung einer Waffe das eigene Volk mitgefährdet, wie es bei Uran- und Wasserstoffbomben der Fall ist. Sich an einem allgemeinen Selbstmord der Menschheit aktiv zu beteiligen, ist schlechthin Schuld.

Nun aber müssen [sic!] wir doch wohl das Problem in Angriff nehmen, welches uns Herr Strauß zum Schluß so dringend ans Herz legte, die Aktion gegen die nuklearen Waffen weiter zu treiben. Und da Göttingen nun einmal das Zentrum dieser Aktion geworden ist, müßtest Du zusammen mit Weizsäcker und Heisenberg (wenn der dazu zu bekommen sein sollte) die Initiative ergreifen. Heute Nachmittag soll ja die Botschaft Albert Schweitzers über die Sender gehen; leider finde ich im gedruckten Rundfunkprogramm keinen Hinweis darauf. [...]”<sup>64</sup>

Hahn expressly stated that in this matter he did not act as the President of the Max Planck Society, but nevertheless the matter was important enough for him to stress his activities as an independent scientist in putting forward his concerns in his presidential address to the annual

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<sup>62</sup> Adenauer, K.: Briefe 1955-1957. Berlin 1998, p.319. – In his memories Adenauer mentioned – in contrast to Strauss – the “achtzehn namhaften deutschen Atomwissenschaftler” [Adenauer, K.: Erinnerungen 1955-1959. Stuttgart 1978, pp.298-299].

<sup>63</sup> Also not discussed here are the reactions of the public on the Declaration of Göttingen. In the MPG-A (Hahn-estate) a sizeable collection of letters from all social groups and classes to Hahn can be found (mainly in agreement, but some also in strong opposition).

<sup>64</sup> Laue to Hahn on 23/4/1957 [MPG-A, NL Hahn, Abt.III, Rep.14A, No.6505, p.1] – On April 23rd, 1957, Albert Schweitzer (1875-1965; NP for peace 1952) – supported by the Oslo Nobel committee – in a speech on Radio Oslo appealed to the statesmen, to stop further atom bomb tests by an international agreement. [see i.e. Nossik, B.M.: Albert Schweitzer – Ein Leben für die Menschlichkeit. Leipzig 1977, p.324f. – The text of his speech *Die Atomgefahr, in der wir heute leben* can be found in: Dokumente zum Göttinger Manifest. Cit. above, p.26-32.

meeting of the Max Planck Society in Lübeck by referring to the Eighteen of Göttingen at the end of his speech. Hahn once again expressed his serious concerns about the arms race and pointed at the Geneva Atomic Conference of 1955 when he suggested that a similar Congress on the prevention of the arms race should be convened.<sup>65</sup> Hedwig Born (1882-1972), the wife of Max Born, wrote to him as an answer:

“[...] Es ist so wichtig, daß wir alle nicht den Mund halten.”<sup>66</sup>

Among the eighteen signatories there were different views and approaches discernible on how to proceed further, but the prevailing view was that it would be inappropriate to appear before the public prior to the General Elections in September 1957; otherwise there was the likelihood of being reproached for taking sides in party politics. It was particularly the opposition party SPD which launched an offensive attitude against atomic armament. Hahn succumbed to this view notably in consideration of his position as the President of the Max Planck Society, but in a letter to Born on 5/9/1957 he wrote the following:

“Ich gebe [...] zu, dass wir ruhig sein sollten v o r der Wahl, aber später bin auch ich eigentlich entschlossen, bei einer passenden Gelegenheit wieder etwas zu sagen.”<sup>67</sup>

There was such a suitable opportunity only a few weeks later with his much-publicized lecture *Atomic Energy for Peace or for War*, an address he made on November 14, 1957, in the Vienna Concert-House at the invitation of the Austrian Cultural Association of Vienna (Österreichischen Kulturvereinigung Wien) in the presence of about 2000 persons.<sup>68</sup> Remaining loyal to his own persuasions, he stood up energetically against an atomic war and made repeated references to the Mainau and Göttingen Declarations, and at the same time he vigorously indicated the possibilities of a peaceful use of nuclear research.<sup>69</sup> In his diary Hahn only noted:

“Mit vielen alten und jungen Kollegen zusammen. Sehr nette Reise.”<sup>70</sup>

With a resolution, accepted at the annual conference of the Association of German Physical Societies (Jahrestagung des Verbandes Deutscher Physikalischer Gesellschaften) in Heidelberg at the end of September 1957 – short after the general elections – the Eighteen of Göttingen had

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<sup>65</sup> Ansprache von Otto Hahn auf der Hauptversammlung der Max-Planck-Gesellschaft 1957 in Lübeck. Mitteilungen aus der MPG H.4/1957, p.194-201.

<sup>66</sup> H.Born to Hahn on 19/7/1957 [MPG-A, NL Hahn, Abt.III, Rep.14A, No.388, p.9].

<sup>67</sup> Hahn to M.Born on 5/9/1957 [MPG-A, NL Hahn, Abt.III, Rep.14A, No.388, p.15].

<sup>68</sup> Hahn had confirmed the lecture on 11/9/1957, that was a few days before the Elections in FRG [MPG-A, NL Hahn, Abt.III, Rep.14A, No.5548, p.15].

<sup>69</sup> The manuscript of the lecture is in MPG-A, NL Hahn, Abt.III, Rep.14A, No.6379. – For notices on these days in Vienna see also in MPG-A, NL Hahn, Abt.III, Rep.14B, No.422-4.

<sup>70</sup> Hahn-Tagebuch No.6 [MPG-A, NL Hahn, Abt.III, Rep.14B, No.421-6, p.12(17)] – But Hahn here also recorded: “[...] Am Saaleingang werden Flugzettel über meinen ‘Verrat’ der Atombombe verteilt. Ich gehe im Vortrag darauf ein.” – This reproach of “treason” aims at the then widespread assertion among nationalistic and reactionary Germans and Austrians, that Hahn during (or after) World War II gave the “atom-secret” to the allies. [See i.e. Hahn, Otto: *Mein Leben*. Cit.above p.193].

confirmed their position.<sup>71</sup> Henceforward Weizsäcker tried to encourage the Eighteen of Göttingen to further public activities, but there were differences in opinion in what to do especially with respect to safeguarding the own nuclear research. And on the other hand the Declaration of Göttingen had induced a powerful anti-nuclear-campaign, which was not fully in the sense of the nuclear scientists and which was political left-wing. Furthermore it was Weizsäcker himself, who caused some differences between the Eighteen. In May 1958 Weizsäcker had published an article entitled *To live with the bomb*, and it seemed to most of the Eighteen that he did leave now the position of the Declaration of Göttingen.<sup>72</sup> Hahn wrote to Born:

“Durch die Broschüre von Weizsäcker, die in der ‘Zeit’ erschienen war, haben ja viele Leute geglaubt, er sei ein bißchen umgefallen. Ich selbst bin oder war zumindest auch der Meinung.”<sup>73</sup>

Max v. Laue, after a talk with Born, expressed himself just more fiercely:

“[...] Wir sind der Ansicht, daß Weizsäcker in Zukunft nicht mehr für die ganze Gruppe sprechen darf, weil diese Artikel mindestens Verwirrung gestiftet haben, wenn sie nicht gar als vollkommener Widerruf gewertet wurden.”<sup>74</sup>

But Hahn could not join in such a conclusion to withdraw Weizsäcker the confidence of speaking on behalf of the Eighteen (obviously, political and tactical aspects had played a role). Hahn’s reservations disappointed both Born and v.Laue.<sup>75</sup> Laue expressed the opinion:

“[...] Wenn die ‘18’ nicht mit dem Kopf durch die Wand gehen, verlieren sie überhaupt ihre Existenzberechtigung. [...] Denn meine Überzeugung und hoffentlich auch die der anderen ‘18’ kommt aus dem Inneren und ist völlig frei von Beeinflussung durch eine Partei.”<sup>76</sup>

And he ended his letter to Born with the following words (following an old students song):

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<sup>71</sup> Confirmation on the occasion of the meeting of physicists 1957 on behalf of the 18 signatories, as communicated by W.Gerlach. In: *Physikalische Blätter* 13(1957)11, p.505. – At the same time the general meeting of the Physical Societies in Heidelberg had confirmed its resolution, accepted in September 1955 in Wiesbaden, which supported the Russel-Einstein-Manifesto and the Declaration of Mainau.

<sup>72</sup> Weizsäcker, Carl Friedrich von: *Mit der Bombe leben. Die gegenwärtigen Aussichten einer Begrenzung der Gefahr eines Atomkriegs.* In: *Die Zeit*, Mai 1958. Reprinted in Weizsäcker, C.F.v.: *Der bedrohte Friede, Politische Aufsätze 1945-1981.* München 1984, pp.43-87.

<sup>73</sup> Hahn to Born on 24/7/1958 [MPG-A, NL Hahn, Abt.III, Rep.14A, No.389, p.37] – Born himself was also unsure how to behave oneself in consideration of the world-political situation. On 18/7/1958 he had written to Hahn: “Obwohl es so aussieht, als ob unsere Sache hinsichtlich des Widerstandes gegen Atomrüstung der Bundeswehr verloren sei, meine ich doch, daß wir noch einen Versuch machen sollten.. [...]” The following was added handwritten: “Dies war vor 8 Tagen diktiert. Die neuen Ereignisse im Nahen Osten machen es vielleicht inopportun, etwas gegen die Atomrüstung zu unternehmen. [...]” [MPG-A, NL Hahn, Abt.III, Rep.14A, No.389, p.36].

<sup>74</sup> Laue to Hahn on 22/8/1958 [MPG-A, NL Hahn, Abt.III, Rep.14A, No.389, p.41].

<sup>75</sup> Born to Hahn on 27/8/1958 [MPG-A, NL Hahn, Abt.III, Rep.14A, No.389, p.43].

<sup>76</sup> Laue to Born on 29/8/1958 [MPG-A, NL Hahn, Abt.III, Rep.14A, No.389, p.44].

“Wer die Wahrheit kennt und sagt sie nicht, der ist fürwahr ein erbärmlicher Wicht. [...] Bitte nehmen Sie diesen Brief für Hahn nach Göttingen mit.”<sup>77</sup>

Hahn was at that time also against a separate action of Born, v.Laue and himself, which had been discussed:

“[...] Ein Punkt der gegen eine Dreier-Erklärung von uns alten Leuten, nämlich Laue, Ihnen und mir spräche, wäre der, dass man dann sagen könnte, diese drei alten verknocherten Gelehrten können sich zu der modernen Entwicklung nicht mehr durchringen, die jüngeren haben dies offenbar getan. Und damit würden wir doch eine ganze Reihe unserer jüngeren Kollegen kränken, [...]”<sup>78</sup>

Thus the activities of the Eighteen of Göttingen as a group had more or less come to an end. A few of them, like Karl Wirtz (1910-1994),<sup>79</sup> were not at all any longer willing to take part in such activities, mainly due to the reason that their involvement in the nuclear research of Germany demanded from them neutrality. After his lecture at the annual meeting of German natural scientists in Wiesbaden in 1958,<sup>80</sup> Hahn noted with a shade of resignation:

“Da ich wieder die 18 nenne und gegen Atomwaffenvermehrung bin, fällt er wohl einem Teil der 4000 Hörer als zu einseitig politisch auf.”<sup>81</sup>

Some of the Eighteen of Göttingen nevertheless were active in further similar activities.<sup>82</sup> Thus in 1959 Born, Hahn, v.Laue and v.Weizsäcker on the occasion of the Lindau meeting initiated the *Vereinigung Deutscher Wissenschaftler* (VDW), something similar to the *Federation of American Scientists*, which accepted an important task in its relations with the Pugwash-movement.<sup>83</sup> Here it should only be mentioned that Hahn in September 1960 sent a message to the Congress of the Japanese Council against A- and H-bombs, where he again argued against production and proliferation of nuclear weapons.<sup>84</sup> And in January 1961 he signed an Appeal to stop the spread of nuclear weapons to more nations or groups of nations.<sup>85</sup>

It seems to me that among the 18 Göttingen scientists Hahn – except for Born and (in some different manner) v.Weizsäcker – was one of the most active persons, also and especially in the

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<sup>77</sup> Ibid.

<sup>78</sup> Hahn to Born on 24/7/1958 [MPG-A, NL Hahn, Abt.III, Rep.14A, No.389, p.37].

<sup>79</sup> See A.Rese: Wirkung politischer Stellungnahmen [...]; cit.above, p.196.

<sup>80</sup> Hahn, Otto: Zur Geschichte der Uranspaltung und den aus dieser Entwicklung entspringenden Konsequenzen. In: *Die Naturwissenschaften* 46(1959)5, pp.158-163.

<sup>81</sup> Cit. after Hahn, Dietrich: Otto Hahn (1979); cit.above, p.296.

<sup>82</sup> Thus Born, Hahn and Heisenberg had signed the international Appeal for an atombomb-test-ban, initiated by Linus Pauling and communicated to the U.N.-General Secretary on 13/1/1958 [MPG-A, NL Hahn, Abt.III, Rep.14A, No.386].

<sup>83</sup> The Pugwash-movement, founded in 1957, was one result of the Russell-Einstein-Manifesto. – See i.e. Rotblat, Joseph: *Scientists in the Quest for Peace – A History of the Puwash Conferences*. Cambridge etc. 1972.

<sup>84</sup> See W.Gerlach: Otto Hahn. Cit.above, p.162.

<sup>85</sup> See MPG-A, NL Hahn, Abt.III, Rep.14A, No.6502.

public, and obviously he was – besides Born – one, who didn't maneuver too much. Reading for instance the article of Heinz Maier-Leibnitz (1911-2000), written on the occasion of the 30th anniversary of the Declaration of Göttingen, one can't help believing that at least a part of the scientists soon became frightened by their own courage.<sup>86</sup>

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<sup>86</sup> Maier-Leibnitz, Heinz: Der Albtraum – Erinnerung an einen historischen Anti-Atom-Appell. Frankfurter Allgemeine Zeitung vom 14.4.1987, p.29.

Plate 1: Signatories of the Russell-Einstein-Manifesto (July 9th, 1955)

|                                   |                                    |                        |
|-----------------------------------|------------------------------------|------------------------|
| Max Born (1882-1970)              | NP physics 1954                    | Germany                |
| Percy W. Bridgman (1882-1961)     | NP physics 1946                    | U.S.A.                 |
| Albert Einstein (1879-1955)       | NP physics 1921                    | U.S.A.                 |
| Leopold Infeld (1898-1968)        |                                    | Poland                 |
| Frédéric Joliot-Curie (1900-1958) | NP chemistry 1935                  | France                 |
| Hermann J.Muller (1890-1967)      | NP medicine 1946                   | U.S.A.                 |
| Linus Pauling (1901-1994)         | NP chemistry 1954<br>NP peace 1962 | U.S.A.                 |
| Cecil F. Powell (1903-1969)       | NP physics 1950                    | Great Britain          |
| Joseph Rotblat (*1908)            | NP peace 1995                      | Poland / Great Britain |
| Bertrand Russell (1872-1970)      | NP literature 1950                 | Great Britain          |
| Hideki Yukawa (1907-1981)         | NP physics 1949                    | Japan                  |

Plate 2: First Signatories of the Declaration of Mainau (July 15th, 1955)

|                                |                   |                  |
|--------------------------------|-------------------|------------------|
| Kurt Alder (1902-1958)         | NP chemistry 1950 | Germany          |
| Max Born (1882-1970)           | NP physics 1954   | Germany          |
| Adolf Butenandt (1903-1995)    | NP chemistry 1939 | Germany          |
| Arthur H. Compton (1892-1962)  | NP physics 1927   | U.S.A.           |
| Gerhard Domagk (1895-1964)     | NP medicine 1939  | Germany          |
| Hans von Euler (1873-1964)     | NP chemistry 1929 | Sweden           |
| Otto Hahn (1879-1968)          | NP chemistry 1944 | Germany          |
| Werner Heisenberg (1901-1976)  | NP physics 1932   | Germany          |
| George Hevesy (1885-1966)      | NP chemistry 1943 | Hungary / Sweden |
| Richard Kuhn (1900-1967)       | NP chemistry 1938 | Germany          |
| Fritz A.Lipmann (1899-1986)    | NP medicine 1953  | U.S.A.           |
| Hermann J.Muller (1890-1967)   | NP medicine 1946  | U.S.A.           |
| Paul Müller (1899-1965)        | NP medicine 1948  | Switzerland      |
| Leopold Ruzicka (1887-1976)    | NP chemistry 1939 | Switzerland      |
| Frederick Soddy (1877-1956)    | NP chemistry 1921 | Great Britain    |
| Wendell M.Stanley (1904-1971)  | NP chemistry 1946 | U.S.A.           |
| Hermann Staudinger (1881-1965) | NP chemistry 1953 | Germany          |
| Hideki Yukawa (1907-1981)      | NP physics 1949   | Japan            |

(Compton and Yukawa were not present in Lindau.)

Plate 3: Members of the working group *Nuclear Physics* in the Federal Ministry for Nuclear Energy in 1956 and 1957

[Arbeitskreis Kernphysik der Fachkommission II „Forschung und Nachwuchs“ der Deutschen Atomkommission (DAtK), die den Bundesminister für Atomfragen beraten sollte]  
(Chairman of the DAtK was the Minister (up to the middle of 1956 it was F.J.Strauss, then S.Balke), one of his vice-chairmen was O.Hahn.)

1956

Heisenberg (chairman), Kopfermann (vice-chairman), Bopp, Bothe, Gentner, Haxel, Jentschke, Maier-Leibnitz, Mattauch, Riezler, Walcher, Weizsäcker. [see Atomkernenergie 1(1956)7/8, p.291]

1957

Heisenberg (chairman), Kopfermann (vice-chairman), Bopp, Gentner, Haxel, Jentschke, Maier-Leibnitz, Mattauch, Paul, Riezler, Walcher, Weizsäcker. [see Atomkernenergie 2(1957)6, p.241]

*Signatories of the letter to vom 19.November 1956 to the Minister of Defence (who was F.J.Strauss then):*

Hahn, v.Weizsäcker, Mattauch, Heisenberg, Walcher, Bothe, Kopfermann, Haxel, Gentner, Riezler, Jentschke, Bopp, Maier-Leibnitz, Paneth

Plate 4: Signatories of the Declaration of Göttingen (April 12th, 1957)

Fritz Bopp (1909-1987)

Max Born (1882-1970, NP 1954)

Rudolf Fleischmann (\*1903)

Walter Gerlach (1889-1979) [detained in Farm-Hall]

Otto Hahn (1879-1968, NP 1944) [detained in Farm-Hall]

Otto Haxel (1909-1989)

Werner Heisenberg (1901-1976, NP 1932) [detained in Farm-Hall]

Hans Kopfermann (1895-1963)

Max v. Laue (1879-1960, NP 1914) [detained in Farm-Hall]

Heinz Maier-Leibnitz (1911-2000)

Josef Mattauch (1895-1976)

Friedrich-Adolf Paneth (1887-1958)

Wolfgang Paul (1913-1993; NP 1989)

Wolfgang Riezler (1905-1962)

Fritz Strassmann (1902-1980)

Wilhelm Walcher (\*1910)

Carl Friedrich Frhr. von Weizsäcker (\*1912) [detained in Farm-Hall]

Karl Wirtz (1910-1994) [detained in Farm-Hall]

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