Phys. perspect. 2 (2000) 336–380
1422–6944/00/040336–44 $ 1.50 + 0.20/0

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Physics in Perspective

The Genesis of Physics at the Hebrew University of Jerusalem

Issachar Unna*

The creation of a good physics department in the newly established Hebrew University in Jerusalem (opened in 1925) was an important goal for Chaim Weizmann, President of the Zionist Organization and founder of the University (and chemist, by profession). A. H. Fraenkel, the mathematician, and L. S. Ornstein, the physicist from Utrecht, invested a lot of effort in achieving this goal. Albert Einstein was consulted on an almost day-to-day basis. Serious attempts were made to bring a first-rate theoretician to Jerusalem. After 1933, the chances for getting such a physicist were actually very good. George Placzek worked in Jerusalem during the academic year 1934–1935. Felix Bloch, Eugene Wigner, and Fritz London were offered positions as theoretical physicists in Jerusalem and considered the offers favorably. The discussions and correspondence with these great physicists are illuminating. Budget limitations, the problem of the teaching language (Hebrew) and the seclusion of Jerusalem from science centers in Europe or the United States undermined all these efforts. A solution was found when Giulio Racah from Italy finally was appointed.

Key words: Hebrew University of Jerusalem; A. Einstein; C. Weizmann; A. H. Fraenkel; L. S. Ornstein; S. Sambursky; E. Alexander; G. Wolfson; R. Samuel; G. Placzek; F. Bloch; E. Wigner; F. London; M. Schiffer; G. Racah.

> In all my life I have never been as Jewish as now. (Fritz Haber to Albert Einstein, 1933)
>
> Just now Prof. Herzfeld is informing me that Dr. London is completely Jewish [*Volljude*], and even a Zionist. He holds important scientific achievements, and can be considered a candidate of the first order. (Albert Einstein to Abraham Ha'levi Fraenkel, 1936)
>
> I think that my knowledge of Hebrew is sufficient to follow the deliberations. (Giulio Racah to Abraham Ha'levi Fraenkel, in his application for membership in the Senate, 1940)

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Introduction

The subject of this paper is the history of physics at the Hebrew University of Jerusalem in its first fifteen years, 1925–1940. When we examine what happened in this period, we are impressed by the will, strong resolve, and dedication of several visionaries who believed that physical science on a high level was a national goal of the highest importance. First and foremost among these were Chaim Weizmann and Abraham Ha'levi Fraenkel. Albert Einstein, with his foresight and attention, stood behind them. His perpetual interest and untiring advice were a source of inspiration to them, and gave them the strength to persevere in their mission.*

The hands of those actively involved, however, were bound, and their feet shackled. During the early years, the one-sided management of Chancellor Jehuda Leib Magnes, who regarded the physical sciences as of secondary importance, rested heavily on the project, and sufficient funds to bring it to fruition were not allocated. This prevented the appointment, for example, of the eminent physicist George Placzek. Only people with strong ties to the country, like Shmuel Sambursky, Ernst Alexander, and Günther Wolfson, prevailed under these conditions.

Even when the management became more academic, after 1935, financial resources were extremely limited, and no physical laboratories were established. Most of the effort was directed at finding a theoretical physicist (at relatively low cost), but even here the largest science centers in the Western world attracted the best scientific intellects.

The isolation and distance of Jerusalem from these scientific centers were further difficulties, which deterred well-known scientists from Germany even after they were forced to emigrate owing to the Nazi racial laws of 1933. Added to this was another condition that bound the hands of the administrators – a candidate would have to be a Jew, if possible a Zionist, who would agree to teach in Hebrew. The goal was to establish Jewish-Zionist-Hebrew physics on an international level. When a Jewish-Zionist physicist (Rudolf Samuel) who wanted to join the university was found, his level of scientific competency was judged to be insufficiently high. Or perhaps others feared that he might usurp parts of experimental physics, which itself was in a poor state. All efforts to find a theoretical physicist of high stature

* A dozen years before the opening of the university, in 1913, Weizmann was active in the establishment of the faculties of medicine and science. Already then, contacts were made with Leonard Ornstein the physicist – and active Zionist – from Holland and also with Bernardo Dessau, the Zionist professor of experimental physics at the University of Perugia in Italy (ref. 5). In 1920 Dessau considered emigrating to Palestine, and asked for advice from Einstein in the matter. Einstein replied in a letter of March 9, 1922: "I cannot recommend to join the Haifa Technion for a really cultured physicist . . . the University of Jerusalem, which is going to be realized soon, is really more acceptable. It is not meant to be a mainly tutorial institution, but more a research institute. You certainly know that I was in America last year to collect funds for this project, with quite substantial success. However, the possibility of realizing a physics institute has not yet been considered owing to the high expenditure connected with it. In case an institute like this will eventually be established you are certainly to be taken into account as a candidate for it, as also Mr. Ornstein from Utrecht, whom you surely know as a diligent colleague in the profession. I confidently hope that we Jews will cause our generation to establish from within ourselves modern research institutes . . . . " Einstein Archives, Jewish National and University Library; hereafter EA, JNUL.

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were dashed by these obstacles, despite tremendous efforts to overcome them at a time of revolutionary developments in physics such as the experimental confirmation of the general theory of relativity (1919) and the consolidation of quantum mechanics (1925–1927).

This paper will deal more with efforts that failed than succeeded in recruiting physicists of the first rank. However, even these barren efforts, some of which came close to succeeding, are meaningful and offer testimony to the ideals of the Zionist leaders and founders of the university and the potential for success after 1933. Indeed, amongst the serious candidates were Felix Bloch and Eugene Wigner, future Nobel Prize winners, as well as outstanding physicists such as George Placzek and Fritz London. Fortunately, as we will see, the Hebrew University emerged on the map of world physics owing to Giulio Racah, an eminent physicist from Italy, a Jew-Zionist, of strong character, who came to the country despite all difficulties and in 1939 was appointed to the chair of theoretical physics. With Racah's appointment the difficult quest for a theoretical physicist of high stature, to be appointed in the small department of experimental physics, came to an end.[1]

Beginnings

The foremost protagonists in the establishment of a research and teaching institute of physics in Jerusalem were four: Weizmann, Einstein, Fraenkel, and Leonard S. Ornstein. Even before the university was opened it was clear to those engaged in its founding – under the leadership of Weizmann – that without the appointment of outstanding scientists in mathematics and theoretical physics there would be no natural sciences worthy of the name at the university. At the first meeting of the Board of Governors* in April of 1925, which was opened by Weizmann (figure 1), the proposed founding of an "Einstein Institute of Mathematics and Physics" was deliberated. The subjects of pure mathematics and theoretical physics were preferred because "these subjects are very suitable to the Jewish character, do not require heavy expenditures, and teachers of the first order are available."[2] However, the establishment of an institute for research and teaching in physics was foremost in the eyes of Weizmann, as part of his Zionist ideal: the foundation of a national home for the Jewish people that also would be a world center of science (Figure 2). Weizmann's achievements and his immense contributions to the founding of the Hebrew University are well known,[3] and we will not discuss them here. For our purposes it is more important to note Weizmann's widespread connections, both professional and personal, with some of the greatest scientists of his day. He was a friend of Ernest Rutherford (Nobel Prize 1908) and the chemist Richard Willstätter (Nobel Prize 1915). He succeeded in involving the bacteriologist Paul Ehrlich (Nobel Prize in medicine and physiology 1908) in the planning of the Hebrew

* Among the members of the Board of Governors were Albert Einstein, Sigmund Freud, Martin Buber, Jacques Hadamard, Edmund Landau, Felix Warburg, Leonard Ornstein, Sir Alfred Mond, Sir Herbert Samuel, James de Rothschild, the Chief Rabbis of England and Austria, the poet Chaim Nachman Bialik, and the writer Ahad Ha'am.

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University. He also attracted Einstein to its cause.[4] In 1921 Weizmann persuaded Einstein to join him on a tour of the United States to raise funds for the imminent establishment of the Hebrew University (figure 3). Two years later Einstein gave a public lecture at the (not yet opened) University on Mount Scopus on the theory of relativity. Einstein also was an active participant in establishing the physics department. Leaders of the university, particularly Fraenkel, consulted with him, and asked his help in their initiatives. Even when Einstein later expressed his annoyance and opposition to the policies of the university's management, he did not deny his help and advice in matters of interest to the department of physics.

Abraham Ha'Levi Fraenkel (b. 1891), famed mathematician and scholar, had been an active Zionist since his youth in Germany (Figure 4). Immediately on his arrival at the Hebrew University in 1929, he occupied a key position on its Governing Board and served as dean of the faculty of humanities from 1930 to 1931. With the establishment of the faculty of science on November 29, 1935, Weizmann was appointed as dean, while Fraenkel served as acting dean until his appointment as rector of the university, in 1938, a position he held until 1940. Both as dean and as rector, Fraenkel invested great effort in the search for suitable appointments in the department of physics. He consulted and corresponded extensively with Weiz-

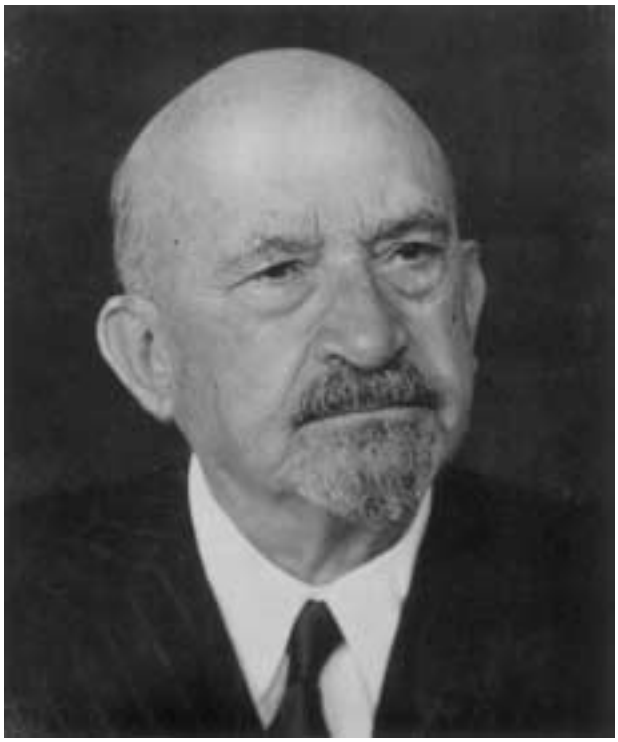

Fig. 1. Chaim Weizmann, President of the Zionist Organization and first chairperson of the Hebrew University Board of Governors. Courtesy of the Hebrew University Archive.

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Fig. 2. The first and final pages of the brochure by Martin Buber, Berthold Feiwel, and Chaim Weizmann proposing a Jewish Institute of Higher Learning in 1902. Courtesy of the Hebrew University Archive.

mann.* He also corresponded extensively with Einstein, especially in connection with his search for suitable appointments in the department of physics.

The eminent Dutch physicist Leonard S. Ornstein (1880–1941), the fourth of our protagonists, was head of a leading department of physics at the University of Utrecht (figure 5). Ornstein had been a student of H. A. Lorentz (Nobel Prize 1902) in Leiden; his subsequent collaboration with Fritz Zernike in optical researches produced results that are still noted in physics textbooks, and he followed these up with significant achievements in atomic and nuclear physics. He also was an active Zionist, and established connection with Weizmann as early as 1913, which led to his cooperation in establishing a faculty of science and medicine at the university.[5] Ornstein was a strong personality who had great organizational ability, and the department he headed at Utrecht drew many researchers to it. Turning from theoretical to experimental problems, he realized already in 1918 that progress in atomic physics demanded precision measurements not only of the frequencies but

* The exchanges of letters, in great part through Weizmann's secretaries, can be found in the Fraenkel Archives, which were recently transferred to the Jewish National and University Library; hereafter FA, JNUL. In these archives I found an inexhaustible source for understanding the period between the years 1930–1940 in the life of the whole university, and particularly in the fields of mathematics and physics. The exchanges of letters between Weizmann, Einstein, Fraenkel, Ornstein, and dozens of scientists and public figures, on the subject of the university, were conducted almost exclusively in German. This leaves little doubt that the German language served, until the outbreak of the Second World War, as the international language of the academic world.

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also the intensities of spectral lines. His and W. R. van Wijk's measurements of the intensities of the spectral lines of the nitrogen molecular ion in 1928 offered strong indication that the nitrogen nucleus is not composed of protons and electrons.

Ornstein was elected as a member of the Academic Council of the university, at the second meeting of the Board of Governors in September 1925. He was asked to join the council as planner and founder of the physics department, and as its head after its establishment. He began to plan the construction of a building for a physics institute, for which an initial sum of 10,000 pounds was allocated. Einstein was elected as head of the Academic Council, and its members also included Martin Buber, Sigmund Freud, and the mathematicians Edmund Landau and Jacques Hadamard.

Fig. 3. Albert Einstein and Chaim Weizmann on their trip to the United States in 1921. Courtesy of the Einstein Archive, the Jewish National and University Library.

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Fig. 4. Abraham Ha'Levi Fraenkel, Jerusalem, year unknown. Courtesy of the Hebrew University Archive.

At the third meeting of the Board of Governors, which was held in London in early August 1926, "certain progress" towards the construction of the physics institute was reported. Ornstein had visited the country earlier in the spring, when he "looked at the plot, and assisted at the preparation of the plans." He stressed the importance of building a central workshop, which would serve the various scientific institutes. At the London meeting he stated that scientific research was more important than teaching, arguing that "it is very important that the university be founded as a serious scientific institution." This prompted a lively debate concerning the relationship between research and teaching. The location of the institute of mathematics was also discussed; it was proposed to house it in a "flat" within the building of the physics institute, once established. The mathematician Landau objected, announcing that "he would prefer a small separate building for mathematics over a large apartment within the physics institute."

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Ornstein planned and directed the development of experimental physics in Jerusalem from his chair in Utrecht; in this he was greatly helped by Shmuel Sambursky, who assisted him in all matters pertaining to research in experimental physics. At the fourth session of the Board of Governors, which was held in London in early June 1928, Ornstein announced that Sambursky "would be appointed permanent assistant in physics and be authorized to lecture on theoretical physics at the mathematics institute." Nine years later, when fascism threatened all of western Europe, Ornstein seriously considered moving from Holland to Jerusalem as head of the physics department.[6] He did not, however, take this step. In November 1940 the Nazi occupiers forbid Ornstein access to his laboratory; six months later he died in Holland.

The Beginnings of Experimental Physics: Shmuel Sambursky (1900–1990)

Shmuel Sambursky was the first physicist at the Hebrew University in Jerusalem (figure 6). As noted above, Ornstein had led the establishment of the physics institute from his residence in Holland. Sambursky was appointed permanent assistant in physics in 1928 and went to see Ornstein in Utrecht to prepare plans for the institute. Sambursky grew up in a Hebrew-Zionist family of Russian origin in Königsberg in eastern Prussia. He was educated in two languages, German and Hebrew, and spoke Hebrew with an excellent accent.* In 1918 he concluded his studies at the classical *Gymnasium*, whence undoubtedly came the roots of his interest in the Greek philosophers; at that time he translated chapters of Homer's

Fig. 5. Leonard S. Ornstein, Utrecht, year unknown. Courtesy of the Hebrew University Archive.

* Sambursky's close friend Gershom Scholem wrote many years later regarding Sambursky's appointment as mathematics teacher at the Teachers' Seminary in 1924: "Regarding him there were no doubts as to his Hebrew accent, even though he grew up in Königsberg among the Yekkes [German Jews], he got his excellent Hebrew from his father who came from Russia and spoke Hebrew without a noticeable accent"; see Gershom Scholem, *From Berlin to Jerusalem* (Tel-Aviv: Am-Oved, 1982), p. 199.

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Fig. 6. Shmuel Sambursky, Jerusalem, year unknown. Courtesy of the Hebrew University Archive.

Odyssey into Hebrew. He also made the acquaintance of the writer S. Y. Agnon (Nobel Prize 1966) in Königsberg.

At the universities of Königsberg and Berlin, Sambursky studied mathematics, physics, and philosophy. Amongst his teachers in Berlin were Max Planck (Nobel Prize 1918), Max von Laue (Nobel Prize 1914), and Gustav Hertz (Nobel Prize 1925), who was his laboratory tutor. Einstein was also in Berlin with an appointment in the Prussian Academy of Sciences. When Einstein in 1921 gave his famous lecture on "Geometry and Experience" (*Geometrie und Erfahrung*), Sambursky was in his audience.

Sambursky's doctorate was in the field of logic and the philosophy of the sciences, with a thesis "On the Proof by Negation in Physics and Mathematics," completed in 1923. His supervisor was Theodor Kaluza (whose important and original achievement in physics received widespread recognition only after a delay

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of sixty years). At the beginning of 1924 Sambursky immigrated to Palestine and was appointed teacher of mathematics and physics at the Teachers' Seminary and at the Hebrew Gymnasium in Jerusalem.

After his appointment to the university in 1928, Sambursky visited Utrecht periodically and carried out research in Ornstein's laboratory on precision measurements of the intensities of spectral lines, a subject of central importance for the new quantum theory. Sambursky's first article dealt with the relative intensities of doublets in alkali atoms. It was published, as were most of his papers during the years 1928–1933, in the *Zeitschrift für Physik*.[7] From them his awareness of developments in the new quantum theory can be detected.* His academic career in Jerusalem spanned over sixty years, from 1928 until almost his last day on earth. He was active in the physics department at the Mount Scopus campus of the Hebrew University, at the temporary quarters in town, and later at the permanent abode on Giv'at Ram, the campus he especially liked. In the earlier years he supervised the building of the physics institute and its laboratories with great affection and recorded his work in detail in his diary.**

The Board of Governors of the university, at a meeting in Zurich in August 1929, decided to start "Elementary courses in physics, in coordination with the heads of the mathematics, chemistry, and biology departments." Sambursky was responsible for these courses. In May 1931 steps were taken to promote him from assistant to lecturer (today, senior lecturer).[8] Letters of reference were requested from Einstein, Niels Bohr, Paul Ehrenfest in Leiden, Samuel Goudsmit in Ann Arbor, Michigan, Otto Stern in Hamburg, B. Pogany in Budapest, and Ornstein in Utrecht. Einstein's opinion was not particularly flattering: "from his work it seems there is the know-how about present-day problems [but] this does not attest to the capability of

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* Everyone conversant with today's physics will smile at the following quotation from Sambursky's first article of 1928: "At the moment it cannot be said what form the theoretical supposition will take to explain the experimental material presented here. Possibly, the conjecture of Goudsmit and Uhlenbeck as to the rotating electron [*rotierendes Elektron*] as a model will present the nearest conformity" (p. 738). In another article, published in the same periodical in 1930, he writes: "the problem of the relative intensities of the alkali doublets found a sufficient solution in the work of Enrico Fermi" (p. 660). The allusion is to Fermi's paper published a few months earlier wherein he developed his famous "Golden Rule."

** After the murder of the university employees in the convoy that made its way to Mount Scopus on April 13, 1948, Sambursky with a few of his students went up the mountain to salvage the instruments of the physics department. Among the papers rescued was also his personal diary of the years 1928–1929, which describes the struggle towards the setting up of the physics institute, and the stages of its development. In his diary, written in his clear and orderly hand, in spare and exact script we read: "2.5.1929 [May 2, 1929]. The casting of the ceilings of the two wings has been finished. I studied with Ing. Wind the question of arranging the transverses meant to carry the electro-motors, which will power the lathes in the workshop. [The page here is accompanied by schematic sketches] . . . Every lathe will occupy about one meter in breadth, between them a space of half a meter. Along the walls tables or cupboards . . . . 5.5.1929 [May 5, 1929] Have been called to see Weizmann to talk about the physics institute. 1.7.1929 [July 1, 1929] . . . Magnes promised me the arrangement of a laboratory for myself. I made a budget for it which came to 1500 Pounds, a budget for instruction 1,000 P, towards the arrangement of an auditorium including temporary electrical installation, and 500 P for a practicum . . . . "

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independent creation which would justify a permanent academic position.''[9] Bohr and Ehrenfest refused to express an opinion on the grounds that they were not competent to judge experimental work. Goudsmit recommended favorably: ''I studied Sambursky's work in detail. In my opinion it is a valuable contribution to this field of physics.'' He noted that he was not personally acquainted with Sambursky. He stressed that Sambursky's future success would depend on the means placed at his disposal in the laboratories. He asked, finally, to be kept informed about everything concerning physics in Jerusalem because of his great interest in the development of the department. Otto Stern, in his reply, described Sambursky as a ''solid experimenter,'' but could not predict Sambursky's chances of success in fields other than the one in which he had worked, namely, on precision measurements of the intensities of multiplet spectral lines. Pogany recommended positively, and added that he trusted Ornstein's judgment, which also was positive.

The Board of Governors met again in Zurich in July 1931, where it decided that ''mathematics will be recognized as a major subject towards an academic title,'' that ''a course of general physics will be given as a secondary subject towards a title, and that Sambursky would be appointed Senior Assistant in physics, and for the present he would be entrusted with instruction and examinations in this subject with absolute freedom of instruction and the sum of 300 P [pounds] would be allocated for the minimal necessary equipment.'' At the same time, the Board concluded ''that the time has not yet come to consider the science departments as a faculty of science.''

Sambursky was an excellent teacher. His compelling lectures had a decisive influence on many students, who became physicists under his spell. After the War of Independence (1948), he turned to the study of the history of physical thought. He achieved international acclaim for his studies on the physics of the Stoa and on the concept of time in neoplatonic thought (figure 7). He initiated the creation of a Science Council to the Israeli Government and headed it after it was founded. He was dean of the faculty of science at the Hebrew University from 1957–1959. In 1968 he was awarded the Israel Prize. He wrote and lectured extensively on the history and philosophy of the physical sciences until his death in 1990.

Theoretical Physics: First Endeavors

The crisis between Albert Einstein and the university authorities reached its peak in June 1928. Einstein had been expressing his dissatisfaction with the management of the institution in general and with J. L. Magnes, the Chancellor (figure 8), in particular for quite some time. He now resigned from the Board of Governors and the Academic Council, which caused great frustration amongst the members of these bodies. His resignation also agitated the academic community in Jerusalem, as is evident from his extensive correspondence at the time. Nevertheless, even while dissociating himself from the Board of Governors, he maintained a warm relationship with Fraenkel (some accused Fraenkel of creating Einstein's negative opinion of Magnes), and he continued to offer advice concerning initiatives in mathematics and physics.[10]

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During this period the question of nominating a candidate for the chair of theoretical physics remained on the agenda of the Board of Governors. Magnes, the Chancellor, wrote to Fraenkel as Dean in March 1930: "We sent word to Prof. Ornstein that you will contact Prof. Ehrenfest regarding a professor of physics. We let him know that in our opinion a professor of physics has to be found, and only after we succeed in acquiring one shall we return to the proposal regarding assistants."[11] In November 1930, Einstein wrote to Fraenkel: "It is preferable to get first of all a physicist of a theoretical tendency. The reason: no sufficient means can be found in the near future to enable an experimental physicist to conduct worthwhile research. On the other hand, there are satisfactory conditions for theoretical work of great achievements. Also, it is easy to find and get a gifted theoretical physicist from amongst the Jews. In the experimental field the conditions in this respect are not convenient." In the same letter Einstein recommended "Mr. [Paul S.] Epstein from Pasadena, who is a theoretical physicist of international renown, and [has] respectable achievements in theory."[12] It seems that this recommendation of Einstein's did not receive further attention.

Two years passed, with the problem of whether to find an experimental or theoretical physicist remaining in the air. Fraenkel sent a detailed report on this subject to Einstein in 1932, in which he outlined the allocations he had obtained for

Fig. 7. Shmuel Sambursky, lecturing in Jerusalem, 1954. Courtesy of the Hebrew University Archive.

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Fig. 8. Judah Leib Magnes, Chancellor of the Hebrew University, 1927. Courtesy of the Hebrew University Archive.

the sciences. He again raised the problem of the division between theoretical and experimental physics and stated, "It will be a pity if we should be forced to tackle the problem without your active help."[13] Fraenkel also complained about Magnes, "who wants to neutralize the senate from any influence in academic matters." In his reply, Einstein expressed his joy that Fraenkel was tackling these matters enthusiastically, and he remarked that he preferred not to get involved but would be glad to answer questions if asked. "I am afraid there will be no real change for the better as long as there will not be a really able manager."[14]

The Nazi's Coming to Power: Refugee Scientists

The events of 1933, when the Nazi party gained power in Germany and the first steps towards the dismissal of Jewish scientists and scholars from German universities were taken, made many German Jews, important scientists among them, realize that unless they emigrated their lives would be in danger. "In all my life I have never been as Jewish as now," wrote the eminent chemist Fritz Haber (Nobel Prize 1918) at the end of a letter to Einstein in the summer of 1933. Haber was a converted Lutheran. Haber now asked Einstein's advice if he should accept Chaim Weizmann's invitation to come to Palestine.[15] German mathematicians, physicists, chemists, scholars in Jewish studies and the humanities, writers and artists, thinkers and academicians – all felt as one that the ground in Germany – their country and their culture – was burning under their feet.

Some of these dismissed scientists naturally tried to respond to the call of the Hebrew University of Jerusalem, possibly leading to some change in its attitude toward the development of the sciences and appointment of scientists. In September

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1933, Weizmann wrote to Chancellor Magnes that, "I have studied the lists of available people and it is really amazing what you can get now. The physical chemist I would like to secure for Jerusalem is Otto Stern (Hamburg) [who would receive the Nobel Prize in 1943]. Absolutely first-class! For physics it would be advisable to secure [Fritz] London. He is distinguished, young, and is sure to impart luster to our physics school . . . . [We] must really seize this opportunity."[16] Stern preferred Pittsburgh to Jerusalem; we shall discuss the London affair below.

Special organizations and foundations were established in many countries to aid the refugee scientists from Germany. Particularly active in this respect were the British. The head of the Academic Assistance Council was Weizmann's friend, Lord Rutherford.

In July 1933, Selig Brodetsky, an active Zionist in England, mathematician, and a future president of the Hebrew University (figure 9), received a letter from Rudolf Samuel, professor of experimental physics at the Islamic University of Aligarh in India requesting a position in the physics department in Jerusalem. Samuel (b. 1897) had been an active Zionist in Germany[17] and had studied in Berlin and in Göttingen with James Franck. In 1931 Samuel was appointed to head the physics department at Aligarh, which he developed into one of the best and most modern in India. He regarded this position, however, only as a stepping stone to Palestine;

Fig. 9. Selig Brodetsky, mathematician, British Zionist leader and President of the Hebrew University, 1949–1952. Courtesy of the Hebrew University Archive.

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he already had sent his wife Erna and son John to Haifa to grow up and be educated in Palestine.

Brodetsky declined Samuel's request, stating, "It will not be fair to offer a post to a Jew who already has a good one outside Germany, when there are so many good scientists who desperately need appointments as a result of the state of affairs in Germany." Brodetsky also reported his refusal to Ornstein, commenting at the same time on Ornstein's recommendations regarding the appointments of Felix Bloch and Ernst Alexander, an experimentalist from Freiburg.[18] We will discuss these two cases below. Samuel did not despair; as we will see, he tried again for an appointment two years later.

The Expansion of Experimental Physics: Ernst Alexander and Günther Wolfson

One of the physicists who came to the Hebrew University from Germany and contributed substantially to the development of experimental physics was Ernst

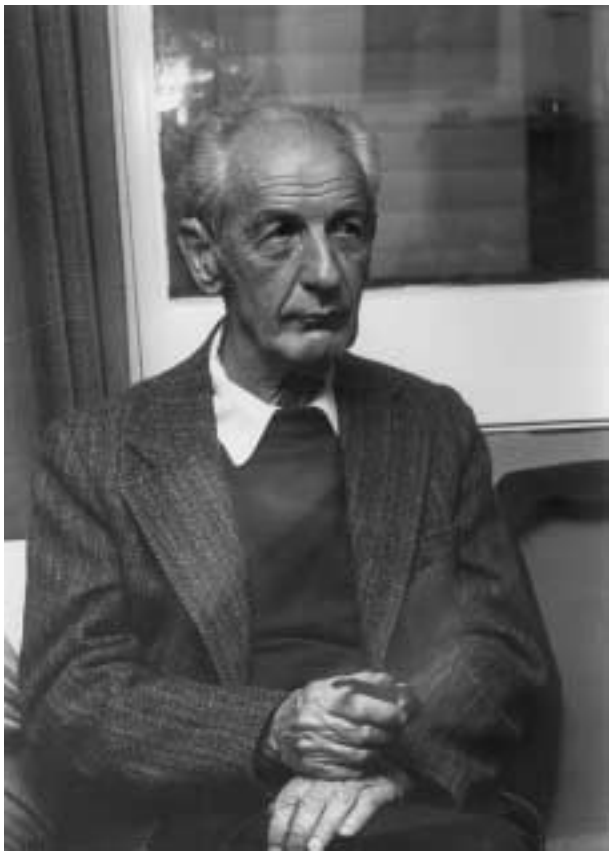

Fig. 10. Ernst Alexander, Jerusalem, year unknown. Courtesy of the Hebrew University Archive.

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Alexander (1902–1980). Alexander (figure 10) was born in Berlin into an assimilated family, but owing to the influence of his Zionist uncle who lived in Galicia, was attracted to Zionism and learned Hebrew from Palestinians studying in Berlin; in return he taught them mathematics and German. He completed his education at the Technische Hochschule in Berlin, where he received his doctorate in 1928. He then went to the University of Freiburg as an assistant to Georg von Hevesy, the discoverer of element 72 (hafnium) and pioneer of the use of radioactive isotopes as tracers (for which he would win a Nobel Prize in 1943). In 1933 Alexander visited Jerusalem as a tourist, but thanks to a loan of 200 pounds won an immigrant's certificate as an "owner of capital" and was allowed to remain in the country.

As an electronics engineer, Alexander proposed to Chaim Weizmann the establishment of a laboratory for electronics – a subject that was then in its infancy. Weizmann refused his request, arguing that electronics still was not suitable for study in a small country like Palestine; nevertheless, as the only physicist then in the country with practical experience, he was accepted into the physics department of the Hebrew University. Sambursky, until then the only physicist at the university, was inclined towards fundamental and theoretical research; Alexander preferred applied physics. Thus, he brought to the department complementary knowledge and skills. He also established in it a fine mechanics workshop.

During his entire career, Alexander's dream was to devote himself to applied physics, and not exclusively to pure research and teaching.* He founded (together with Sambursky and Wolfson, see below) the department of experimental physics in Jerusalem, and headed it for many years. He was an active partner in the planning and development of many scientific instruments that were built from scratch in the workshop he had founded. His research field was X-ray crystallography, for which he developed a special X-ray tube (known as "Alexander's tube"). He also developed some of the theoretical tools he needed (for instance, a classification scheme for two-dimensional space groups and Fourier-analysis techniques for X-ray photographs). From 1959–1963 he served as dean of the faculty of science.

* The Second World War, and the drafting of the university to the war effort, gave Alexander the opportunity he had wished for – to exceed the bounds of theory, and to assist in the practical solution of problems. In 1980, in a lecture given in memory of Alexander, Sambursky described the crucial role of the physics department in the war effort during the years 1942–1945, an effort in which Sambursky, Alexander, and Wolfson played a central role. "The significance of this effort much exceeded the actual technical achievements, which helped the allies in their war against Hitler. All the work of the department was harnessed to the effort in two practical and technical fields: a) the repair of big transmission tubes for broadcasting to allied submarines from Beirut to the Mediterranean, and kept contact from shore to sea. b) the cutting and filing of quartz plates of exact thickness, to stabilize the frequencies of radio transmissions of the English bombers bombing Sicily, Romanian oil fields and other German-held places . . . . Within this framework, thousands of tubes were repaired, and thousands of plates were filed to the precision of thousandths of a millimeter. As there was almost no contact with Europe during those years, the physics department was the only source of supply of these quartz plates at the rate the high command in Cairo ordered them, and the whole British Air Force in the Middle East depended on the plates produced by the physics department in Jerusalem. This fact, whose importance cannot be overrated, strengthened the status of the university and with it the position of the whole Jewish community versus the government of the British Mandate." See S. Sambursky, "Ernst Alexander, one of the founders of physics in Israel," *Mada* **24**, 2 (1980), 92.

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Another physicist from Germany was Günther Wolfson (1901–1948), who was born in Elberfeld and had studied at the Universities of Frankfurt, Heidelberg, Munich, and Bonn. He then went to Berlin where he served as a scientific assistant first at the Kaiser Wilhelm Institute of Physical Chemistry (Fritz Haber's institute) and later in the department of spectroscopy of the Physikalisch-Technische Reichsanstalt. He wrote an essay on the velocity of light for the *Handbuch der Physik* in 1926 (Vol. XIX), and one on the diffraction and interference of light in 1928 (Vol. XX). In 1933 he was dismissed from his position and found refuge in Ornstein's laboratory in Utrecht. Ornstein had a high opinion of Wolfson, and following his and Mark Zemanski's recommendations was appointed instructor in experimental physics at the Hebrew University in 1934. He was killed in the convoy to Mount Scopus (1948).

The George Placzek Affair: The Theoretician who Demanded a Laboratory

By 1934 a suitable appointment to the chair of theoretical physics still had not been made, even though a number of first-class candidates had become available.

Ornstein, in a letter of March 1934 to Chancellor Magnes, proposed three names: George Placzek (''who is at present in Copenhagen''), Walter Heitler (''at the moment in Bristol''), and Lothar Nordheim (''who is said to come to Utrecht'').[19] Placzek, heading the list, was only 28 years old, but already was known as an incisive, brilliant physicist of broad education and a fascinating personality. As it turned out, he actually stayed at the Hebrew University for six months during the academic year 1934–35. The process of his appointment and the way it was dealt with during his stay in the country – until he ''slammed the door'' on the university – were characteristic of the difficulties and complications that accompanied this early stage in the development of the physics department.

George Placzek (1905–1955) was the first-born of a wealthy Jewish family in Brünn, Moravia (today, Brno, Czech Republic).[20] His talents in science and languages already stood out during his years in secondary school, when he became well-known for his broad and deep erudition. He pursued his higher education at the Universities of Prague and Vienna, where he received his doctorate in 1928. His ever-increasing circle of friends and colleagues in Europe found him to be a charismatic, witty man with a deep knowledge in physics. From 1928 to 1931 he worked in Utrecht with H. A. Kramers and Ornstein; from 1931 to 1932 he was with Enrico Fermi in Rome, where he also met Hans Bethe, Edward Teller, and Eduardo Amaldi; and from 1932 to 1934 he was with Niels Bohr, Otto Robert Frisch and others in Copenhagen. In 1934 he also worked for six months with Lev Landau in Kharkov.

When Ornstein proposed Placzek for a post at the Hebrew University in 1934, he was already well known owing to fundamental articles that he had written on the theory of Raman scattering. In 1933 he published jointly with Teller an article on ''The rotational structure of Raman bands in multi-atomic molecules,''[21] in which they used the methods of group theory and methods that later were recognized as part of Wigner's and Racah's methods in spectroscopy. Another article, published

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in collaboration with Amaldi,[22] was an experimental work confirming the above theoretical calculations. In 1932, after the discovery of the neutron, Placzek immediately turned his attention to nuclear physics and within a few years was recognized as an authority on the scattering of neutrons and their absorption in matter. He was one of the first to recognize the importance of and contribute to the new field of nuclear physics.

In June 1934, Sambursky asked Magnes to speak to Placzek,[23] who was in Berlin, and to convince him to come to the Hebrew University for more than half a year. Ornstein, too, wrote to Placzek in August telling him that the language of instruction in Jerusalem is Hebrew, but that one is permitted to teach in another language for one year.[24] The Board of Governors of the University met later that month in Zurich with the subject of physics on its agenda. The Board adopted the following two resolutions: (1) to appoint Sambursky as lecturer in experimental physics; to confirm Alexander as permanent assistant; and to appoint Wolfson as permanent assistant at the physics institute; and (2) to found, at the physics institute, a chair for theoretical physics and to empower the executive committee to appoint the professor to this chair, subject to the endorsement of the university council. Four candidates for this chair were proposed, to be approached in the following order: Placzek, Heitler, London, Nordheim.

The discussions at the university about Placzek's nomination were difficult and agitated, and continued until November 1934. A special committee was appointed whose members were A. H. Fraenkel, M. Fekete, A. Fodor, S. Klein and S. Sambursky. The committee expressed concern that the award of a professorship to someone so young might cause discontent among the rest of the faculty of the university, and it therefore proposed to accord him the rank of lecturer and to elevate him to professor only after he had become proficient in Hebrew.[25] Ornstein, who was charged to negotiate with Placzek, reacted with chagrin to this proposal: he did not agree with the committee and argued that its considerations were miserly; that its members did not understand the difficulties in finding a first-rate theoretical physicist (''that is how they lost Felix Bloch''[26]); and Placzek was an eminent one. Ornstein was prepared to approach Placzek only if the committee agreed to accept him at the rank of professor, and for one full year.[27] Meanwhile, a financial problem arose: the special fund to be used for the appointment was designated for refugee scientists from Germany, and Placzek was not a refugee from Germany! Zalman Schoken, Chairman of the Executive Committee, blamed Ornstein for overlooking the aim of appointing a refugee from Germany, but Schoken also understood from a conversation with Weizmann that Weizmann ''would see any interference with Placzek's invitation as a serious blow to the University.''[28]

In May 1935, a meeting took place in Chancellor Magnes's office, and in the presence of S. Ginzberg, the Academic Secretary, Magnes discussed with Placzek his terms for accepting a permanent appointment in Jerusalem. Placzek's terms included personal items, but most of his conditions related to the development of the physics department. He maintained that Ornstein had promised him a travel budget to Europe (200 P). Magnes explained that ''we do not have such an arrangement, and there is no hint as to it in Ornstein's letter.'' Placzek said that Ornstein had promised him a high-level assistant, a position he would fill with

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Edward Teller. Magnes did not object, probably because he understood from Placzek that this in any case was not feasible in the near future. The discussion then expanded to the place of theoretical physics in general in the Hebrew University, and Placzek promised to prepare a memorandum on this question. After the meeting, Magnes reported: "I was disappointed to hear that Placzek thinks an investment of 20,000 P is needed, and a yearly expenditure of 3,500 P, but we were told that a theoretical physicist needed only a blackboard and chalk or paper and pencil."

Placzek insisted in his meeting with Magnes on the foundation of a department of experimental nuclear physics – this only three years after the discovery of the neutron. Magnes commented that he intended to assist only the laboratories for optics and physical chemistry. Placzek answered that others might be content with that, but he did not expect from Ornstein that these laboratories actually contained such poor equipment. "Here, the equipment is inferior to that of a secondary school in Germany. This is not criticism. It is only a description of the situation." To improve this situation, because Placzek continued to maintain his great interest in moving to Palestine, he proposed to turn to Arthur H. Compton in Chicago, James Franck at The Johns Hopkins University in Baltimore, and to Einstein for help in raising funds, "for otherwise it will be impossible to act."

Placzek was willing to postpone a discussion of his academic rank, but at the same time he advanced definite administrative demands: a separate secretariat for physics and physical chemistry, and separate and less cumbersome and complicated management ("desks which had been ordered months ago arrived only now"). Magnes commented that even a separate secretariat would not expedite such administrative matters. Then the question of an assistant was raised again (Teller?), and here Magnes noted: "this will require so many committees . . . . " At this point M. Schloessinger (the deputy chancellor) entered the room, and asked Placzek if he had another offer of an appointment somewhere else, to which Placzek answered: "at this moment this is beside the point because I would like to stay here."[29]

A week later S. Ginzberg, the Academic Secretary, sent a letter to Magnes in which he discussed Placzek's demands.[30] Concerning a separate secretariat for physics and physical chemistry, Ginzberg voiced a negative opinion. Placzek's demands regarding a physics laboratory also were greatly exaggerated; he should not be allowed to recruit funds in America. Placzek's demands for his salary and traveling expenses were totally out of bounds; in Ginzberg's words, "he himself said that maybe somebody else would be content with less." Ginzberg concluded that Placzek and the university were incompatible, and "the sooner we decide [this] the better." They would have to find someone else, and Ginzberg then raised the possible candidacy of Felix Bloch: "I heard that Dr. Bloch could be taken into account. From what one hears he is a better physicist, and a better Jew." Schloessinger, too, sent a note to Magnes saying: "His [Placzek's] demands are so exaggerated as to make it impossible for me to take the whole matter seriously. Also, I do not recommend writing about it to America, as this would reflect unfavorably on the acumen of our judgment."[31]

In June 1935, Placzek submitted two documents to Magnes specifying his demands. The first, on June 5, dealt with theoretical physics, and here he again

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advanced the candidacy of Edward Teller as assistant, although by then it was clear that Teller could not come to Jerusalem for at least a year or two, since he had just received an appointment at George Washington University. The second document, on June 15, was a detailed proposal for the foundation of a nuclear physics department, with a budget of 27,000 P.[32]

Meanwhile, however, even before Placzek submitted his second document to Magnes, Magnes himself had sent a letter on June 10 to Schloessinger and Schocken, in which he stated unequivocally: we cannot agree to Placzek's demands, and we therefore must send a telegram to Bloch in California opening negotiations with him.[33] Almost simultaneously, Schocken sent a letter to Magnes,[34] in which he did not foreclose the possibility of accommodating Placzek's demands, mainly because "he is ready to start teaching in Hebrew next year." Soon thereafter, taking Placzek's documents and everything else into account, Magnes sent Placzek an official letter, dated July 4, 1935, in which he offered Placzek an appointment to a permanent position at the university under the following conditions:

> Position of lecturer with rights of professor at a salary of 420 P per annum, "the highest salary at the university."
> The sum of 88 P, once, for travel.
> Assistance – one orderly assistant.
> No additional secretarial assistance will be provided.
> No possibility of nuclear physics (experimental) research will be provided.
> No promise of additional rooms.

One week later, on July 11, another meeting took place between Placzek and Magnes. Magnes wrote (in Hebrew!) a memorandum of that meeting, reporting: "Was with me for an hour. Announced that he could not accept the conditions of appointment offered him in the letter of July 4, 1935. He wanted to participate in building up, and we offer him static conditions. There were too many misunderstandings from the outset, but he does not want to blame Ornstein for this. We stand no chance in nuclear physics and therefore he is right to leave, although he could work 5 months (July–December) each year abroad. Magnes, however, thought that these were not 'static' conditions but first steps toward the creation of theoretical physics at the university. 'After all, he is still young . . . . [What] bothers him is the tendency [*Einstellung*]. [He thought] conditions would be more amenable. He is sorry, because the country made a deep impression on him. Was far from Judaism but the country began to fascinate him [*Ihn zu faszinieren*]."

> I repeated my offer if he could come to terms with the fact that there is no chance for nuclear physics. Answered it was impossible. Would help as much as he could. Spoke about Bloch. To his mind – Bloch will not accept our conditions. He mentioned other names: Wigner in Princeton, Peierls from Munich (now in Manchester), Breslau – older, Fröhlich – a young man who was in Russia. Placzek himself plans to go to England, and afterwards to Copenhagen and possibly also to America. Does not believe it would be difficult to get a suitable appointment.[35]

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A couple of days later, Placzek sent an official letter to Magnes, giving his reasons, as above, for rejecting the offer. His departure was accompanied by another discord, when it turned out that he did not receive the entire salary that the university had promised him in a telegram to Ornstein in November 1934: He received only 300 P instead of 400 P. Someone in the academic secretariat claimed that the promised amount was for the entire academic year whereas Placzek actually stayed in the country only six months.

Placzek returned to Copenhagen after sending a telegram to Otto Robert Frisch: "THROUGH WITH JEWS FOR EVER."[36] In Copenhagen, Placzek made significant contributions to nuclear physics, becoming an authority on the scattering and absorption of neutrons, and nuclear fission. He used Bohr's Nobel Prize medal, for example, to measure the absorption cross section for slow neutrons in gold. He stimulated Frisch to carry out the first experiments that confirmed nuclear fission.[37] He left Copenhagen for Paris in 1938 and in 1939 was appointed as a research associate at Cornell University (figure 11). In 1942 he became head of the department of theoretical physics at the Chalk River nuclear research center in Canada. At the end of World War II, he moved to Los Alamos for a year, then became a research physicist in the General Electric Company before being appointed member of the Institute for Advanced Study in Princeton in 1948. He died in October 1955 of a heart attack, at the age of fifty.

The Felix Bloch Story

As early as the summer of 1933 (before the Placzek affair), serious negotiations began in an attempt to bring Felix Bloch (1905–1983) to Jerusalem as professor of theoretical physics at the Hebrew University.[38] In January 1934, Bloch (who would win the Nobel Prize in 1952), informed Chancellor Magnes that he was declining the offer because Stanford University had made him a far better offer. At the same time, Bloch expressed his hope that he might be able to devote his abilities to the Hebrew University in the future.[39] From subsequent correspondence we know that Bloch expected his contract with Stanford to end in the fall of 1936.[40]

Immediately after Placzek's official resignation in July 1935, contact with Bloch was renewed. Magnes sent a letter to Ornstein,[41] reporting the events leading to Placzek's resignation and then told him that "we cabled Bloch whether in principle he would be willing to be professor of theoretical physics," and told him that a nomination committee had been formed, consisting of Michael Fekete, Ladislau Farkas,[42] and Sambursky. Magnes also mentioned the possibility of approaching other well-known physicists: Hans Bethe, Eugene Wigner, Fritz London, and Rudolf Peierls.

Two weeks later, on July 29, 1935, Fraenkel wrote the academic secretary,[43] saying that the position could be held open for Bloch until that fall, under three conditions:

a. That Bloch will commit himself unequivocally to come.

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Fig. 11. George Placzek at Cornell University, 1939. Photo by Ladislau Farkas. Courtesy of Mrs. Leorah Kroyanker (daughter of Ladislau Farkas) and the Farkas Archive, the Jewish National and University Library.

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b. That the arrangements already decided upon for the academic year 1935–36 will remain valid (the recognition of physics as a secondary subject, and the foundation of a faculty of science).
c. That Bloch will start learning Hebrew whilst still in America (if he had not done so already).

At the end of August 1935, Fekete met with Bloch in Zurich. Fekete gave a detailed summary of their meeting, as follows:

1. Bloch regards an invitation to work in a theoretical physics department favorably.
2. He will be able to consider such an invitation only at the beginning of October 1936, because until then he is committed to Stanford.
3. He asks for a professorship [*Ordinariat*] at the minimum of the salary scale [*regulären*] for an Ordinarius [at that time about 500 P].
4. As the main emphasis in Jerusalem is on theoretical physics, Bloch thinks it proper to entrust the ordinarius for theoretical physics with the management of the physics institute (however, this is not an unconditional demand).
5. Considering the financial and academic conditions prevailing in Jerusalem, Bloch will be content with a junior assistant to deal with exercises, aid in administrative matters, and be able to participate in scientific discussions.
6. A budget for the library has to be allotted for subscriptions to important journals and the acquisition of necessary books.
7. Bloch views Zionism favorably, but is not a member of any party.
8. Bloch learned Hebrew in the past, with some success. He has forgotten most of it, but is not afraid to learn the language anew and to teach in it.
9. Even if conditions 2–6 are accepted, Bloch will not be able to commit himself now. He will have to wait for a decision concerning him at the university where he is now [Stanford]. He asks for an extension until this October, at the latest.[44]

In October 1935, therefore, Fraenkel sent a letter to Weizmann asking him to approach Bloch to obtain his consent to the appointment. Fraenkel told Weizmann: "Bloch's conditions are: a junior assistant and an allocation for the library. He does not insist on the integration and joint management of experimental and theoretical physics. We, with Ornstein, tend towards a separate administration. If you can obtain his consent to the appointment as from next autumn, it will be of the greatest importance."[45]

In the fall of 1935, important changes in the structure of the Hebrew University as a whole were being made, and in particular in the natural sciences, following the recommendations of the Hartog committee.[46] Magnes, who until then held the post of Chancellor, now became President, with the result that his almost all-embracing and exclusive authority in administrative and academic matters was diminished greatly; the body that was now empowered to make decisions in academic matters was the Senate and its committees. On November 29, 1935, the founding meeting of the council of the faculty of science was held, under the chairmanship of the first

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dean, Chaim Weizmann. In his opening remarks he congratulated the rector, Hugo Bergmann, on his appointment, and on the spot nominated Fraenkel as his own deputy. The council decided to call the faculty "the faculty of science and mathematics," and the meeting concluded with a solemn declaration of the dean, Weizmann, establishing the faculty. At its second meeting on December 11, 1935, the council decided to change the name to "the faculty of mathematics and science."[47]

At a meeting of the faculty board on December 5, 1935, at the Sieff Institute in Rehovoth, the matter of Felix Bloch was discussed. The board adopted an official resolution to send a formal invitation, which also was signed by Schocken, to Bloch to join the physics department. Weizmann commented that if the nomination of Bloch, a Swiss Jew, was implemented, then it would be possible to take into account a substantial donation from Swiss Jews (10–15 thousand Swiss francs). He added that the arrival of Bloch would necessitate the consolidation and expansion of experimental physics at the university, but any such development would be extremely costly. At this point Sambursky outlined the most urgent financial needs of the department,[48] and it was decided to turn to South Africa, as the university had in the past, to seek funds. The Farkas professorship of physical chemistry and the field of mineralogy were also discussed. About a week later, Fraenkel reported to the faculty board on his negotiations with Bloch and on additional equipment needed for the physics department, to lay the groundwork for turning physics into a major subject during the 1936–37 academic year.

The financial problems that arose, owing to Bloch's demands, were deliberated by the Executive Committee of the faculty council at the end of December 1935.[49] Bloch's appointment was approved by the Executive Committee and by the Senate. An official notification of these actions was sent to Weizmann as dean in January 1936.[50]

We also learn about the negotiations with Bloch from a letter that the rector, Bergmann, sent to Einstein in Princeton, at the beginning of February 1936.[51] We recall that Einstein severed his ties with the Hebrew University at the end of the 1920s; now, after the change in its structure, and the resulting diminution of Magnes's authority, Einstein resumed his cooperation. Bergmann expressed his joy over Einstein's renewed cooperation, and gave him a report on the administrative and academic state of the university: there are about 600 students; Weizmann and Fraenkel are organizing the faculty of mathematics and science; the institute for physical chemistry under Farkas has been opened; and they hope to fill the chair for theoretical physics soon – Weizmann is negotiating with Bloch. On February 23, Einstein wrote to Fraenkel noting that his relationship with Weizmann is cordial. He thus is no longer in a position of conflict (*Kampfstellung*), and since the conflict never was personal, he will be glad to assist in any matter, and of course to visit the country again.[52]

At the end of February 1936, Bloch was asked by telegram to cable his decision to the university.[53] Five days later Bloch's telegram was received, and announced that his letter of rejection (*Ablehnung*) was on its way.[54] This letter seems to be lost, but there can be no doubt about its content: Bloch preferred to remain at Stanford, where he saw a bright future ahead of him (figure 12). Fraenkel soon prepared a detailed

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report on the condition of the faculty of natural sciences, which included the following statement: "The efforts to appoint a professor of theoretical physics concluded after negotiations which took months, when Felix Bloch announced he would not accept the nomination."[55] The great disappointment of Fraenkel and his colleagues was evident.

Eugene Wigner

Later in the above report, Fraenkel stated: "right after this shock [of Bloch's declining the appointment] we opened negotiations with Prof. Eugene Wigner [1902–1995]. These are progressing well, and we hope for a positive conclusion even before this report is submitted." Wigner undoubtedly was the most eminent theoretical physicist with whom the Hebrew University seriously negotiated about joining its faculty.

Wigner was born into a Jewish family in Budapest in 1902.[56] In 1915 the family converted to the Lutheran church. Wigner received his higher education in Berlin in chemical engineering, was profoundly influenced by the new quantum theory, and from the outset made significant contributions to it (figures 13 and 14). He visited Palestine for a few weeks during May and June of 1935 on the invitation of his friend, Ladislau Farkas. Besides touring the country together, the two wrote a joint paper.[57]

Fig. 12. Felix Bloch (left) receiving his Honorary Doctorate from Giulio Racah, Rector and Acting President of the Hebrew University, 1962. Courtesy of the Hebrew University Archive.

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Fig. 13. *Left to right*: Adalbert Farkas, Eugene Wigner, Paul A. M. Dirac, Ladislau Farkas, Budapest, 1935. Courtesy of Mrs. Leorah Kroyanker (daughter of Ladislau Farkas) and the Farkas Archive, the Jewish National and University Library.

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Fig. 14. *Left to right*: Paul A. M. Dirac, Margit Wigner, her brother Eugene Wigner, Adalbert Farkas, Budapest, 1935. Margit Wigner married Dirac in 1937. Courtesy of Mrs. Leorah Kroyanker (daughter of Ladislau Farkas) and the Farkas Archive, the Jewish National and University Library.

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Negotiations with Wigner started in March 1936. Fraenkel, after receiving the consent of Ornstein and the appropriate university bodies, approached Wigner, and then informed Weizmann that Wigner had given his consent to the appointment in principle, noting that he might come to Jerusalem as early as October 1936. "Yesterday, the university cabled him the conditions in detail. It is to be hoped everything will continue in such a smooth fashion. We are all very glad at the chance of getting such an eminent scholar."[58]

From exchanges of telegrams and letters between the university and Wigner we learn that not everything went so smoothly.[59] Wigner's initial response to the offer of a professorship in Jerusalem was, "I shall be glad to come, and I will be able to come probably in October." A cable and a letter were then sent to Wigner in March 1936 detailing the conditions of the appointment: "full salary of a professor, i.e. 508 P per annum, one junior assistant, a special allotment of 50–100 P for a joint library with physical chemistry budgeted at 120 P p.a." The language of instruction will be exclusively Hebrew, and therefore Wigner will have to learn this language. It would be desirable for him to start teaching during the coming academic year 1936–37 (but not necessarily in October). Thus he should "use every opportunity whilst still in the U.S. to acquire the language." In response, at the end of that month, Fraenkel received a detailed letter from Wigner that did not augur well for the future.

Wigner apologized for his procrastination in reaching a decision, "which is to be fateful for all my life." He went on to write: "It is clear to me that I have to acquire the Hebrew language, and to teach in it, although I am not particularly gifted in languages [*obwohl mein Sprachtalent viel zu wuenschen uebrig laesst*]. Maybe I should start by teaching in a language I know, and about this it would be better to talk in person." He then raised a number of issues, which he hoped Fraenkel could resolve:

> a. It is important that not all of the instruction in theoretical physics should be left in my hands; it would be too much of a burden. I do not want [to teach] more than five hours weekly (in addition to discussion groups). It is also important that the students should not hear everything from the same person. Therefore a senior assistant would be preferable to a junior one. I know how difficult the chances of advancement are in a small and isolated country, and it will therefore be difficult to find such an assistant. I suppose I will be given great freedom in the matter of choosing an assistant.
> b. To the question of salary, I suppose there was a mistake in the cable (there the number quoted was 508 P), in America I have 5,000 dollars. For this reason my family objects to the Palestine plan (*Palestina Plan*). I shall not bind myself to this number, but I hope we shall be able to soften this consideration.
> c. To the question of the library: the sum needed is at least 100 P, in addition to the secretarial work. I very much hope you agree with me on the necessity of these subjects, and that you will convince the faculty of it. I suppose there is no need to stress my thanks to you in this matter.
>
> To my regret, there are three additional points I have to raise:
>
> 1. I cannot come this autumn, but only for the second semester.

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> 2. I beg not to publish the matter of my appointment until the first of August, as I want to receive American citizenship, and the publication would make it difficult for me to get it.
> As for the third point, I have written directly to Farkas and at the same time shall ask him to talk to you about the matter.

We do not know what the third point was. We might speculate, however, that it may well have dealt with Wigner being a converted Christian.

At the beginning of May 1936, during a meeting with Weizmann, there were hints about the difficulties that had arisen in the negotiations with Wigner,[60] the foremost one being the salary problem. Fraenkel was authorized to cable Wigner immediately to elucidate the remaining problems. Weizmann pointed out that the nomination to the chair of experimental physics should be dealt with vigorously, "because theoretical physics is dependent on the existence of experimental physics." The candidacy of Rudolf Samuel was mentioned (see below). Following this meeting two cables were sent to Wigner. The official cable from the university again quoted the salary figure of 508 P and also stated that "the requests regarding the library can be fulfilled. It is requested he come as quickly as possible. Not later than spring 1937." Fraenkel sent a follow-up telegram to Wigner that same day, explaining that "a salary of 508 pounds is equal to the salary abroad considering the local standard of living. It is possible to obtain a professional increment of 75 pounds p.a. The rest of the requests have been ratified! Concerning the personal point [the third point?] – Not to worry! Hoping for a positive, firm [*feste*] and speedy [*baldige*] answer at the earliest possible time."

From Fraenkel's report on the state of the faculty of science noted above,[61] we know that at the beginning of June 1936 he was still optimistic that the negotiations with Wigner would end positively. By the middle of that month, however, Fraenkel knew, much to his regret, that Wigner was not going to come to Jerusalem. He reported this outcome in letters to Einstein[62] and to Josef Cohen, Weizmann's secretary in London,[63] adding in parentheses that there may be a connection between Wigner's refusal and the disturbances, that is, the troubles between Arabs and Jews, which were at their peak at that time.

At the beginning of July 1936, Wigner wrote an official letter of refusal to Fraenkel, stating:

> I arrived in Budapest this instant and found your kind lines from Jerusalem. My heartfelt thanks for your efforts on my behalf. From the beginning I thought I would not be able to safeguard my ties with Princeton, as I had to be away for prolonged periods of time, and therefore tended towards Palestine. However, 3 days before my telegram I received an offer from the University of Wisconsin which I preferred to a final leap into conditions, in part foreign to me, in Jerusalem. Had I rejected Wisconsin I would have had to give up Princeton, too, even if I had gone to Palestine for only one year. I understood the possibility of a temporary visit in the way that if I found a free half a year I would spend it at your university; I shall not wait for an invitation, simply would arrive unless unwelcome. May I add, that the fact of my invitation to Jerusalem was not exploited in any way in the course of my negotiation in America. In Madison nobody knows about it, and at Princeton only von Neumann knows of it.[64]

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Wigner's letter concludes with his characteristic courtesies and apologies. However, regardless of his contention that to decline Wisconsin's offer carried with it giving up his Princeton position, it seems likely that the conditions offered by the Hebrew University, particularly the salary figure and the requirement of teaching in Hebrew, were the important factors in Wigner's negative decision to depart for Jerusalem.

The Rudolf Samuel Affair

Contrary to Placzek, Bloch, and Wigner, Rudolf Samuel (1897–1949) was an experimental physicist, and an ardent Zionist, who wanted to join the Hebrew University at any cost. As noted above, he sent his family to Haifa whilst he was still head of the physics department at the Islamic University at Aligarh in India. In 1933, as we have seen, Brodetsky turned down his request to be appointed to the Hebrew University in Jerusalem, as he already had found a position outside Germany.

Samuel renewed his application to the Hebrew University at the end of 1935. In a warm letter of recommendation, Sir C. V. Raman pointed out Samuel's great success in establishing an active and modern department that became "one of the leading centres for the progress of Physics in India." Raman then explained that "a reactionary change of a regrettable character" had occurred at the Islamic University whose leadership now will "no longer [make] room for any non-Muslim teacher, however competent or efficient, on its staff."[65]

Fraenkel responded to Samuel in February 1936, saying that although Weizmann was positively disposed to his application, the financial problems facing the exact natural sciences ("which get the treatment of a step-child") left no hope for it. Beyond the minimal plans of maintaining laboratories for the lecturer Sambursky, the assistants Alexander and Wolfson, and the recruitment of a theoretical physicist, there was grave doubt something else could be done.[66] Weizmann probably wanted very much to help Samuel, as an active Zionist. Ornstein, however, was entirely negative, writing Weizmann in March 1936 that:

> Samuel is second-grade. His work is unimportant, and only impresses somewhat by its volume. He did not do anything important. Born's opinion [Max Born also had sent a letter of recommendation to Weizmann] cannot be taken too seriously. He is a very good theoretician but has no deep understanding of experimental work. I received an opinion on Samuel from [James] Franck. When I answered him what my opinion was he replied that the motive for his letter was compassion [*Mitleid*]. I am afraid this is also Born's motive. In any case it would be most unjust to appoint Samuel professor in charge of Sambursky and Wolfson. I hope you have been convinced not to act without hearing the opinion of the curatorium.[67]

Samuel, however, did not yield. On March 10, 1936, he responded to Fraenkel's February letter complaining that his previous letters to Weizmann, Brodetzky, Ornstein and Magnes did not receive matter-of-fact responses. From the beginning

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of his career, he said, he had wanted a position in Jerusalem, no matter how minor, because he and his wife were veteran Zionists: "We are fed up with living abroad. Our only son goes to school in Haifa. We parted so that he at least could grow up in the country. For 20 years my goal has been to come to Palestine, and work there."[68]

Four months later, in July, Samuel submitted a detailed program for the development of physics in Jerusalem, wherein he expressed optimism regarding the possibility of raising funds and obtaining apparatus on loan.[69] Einstein, who also had been asked about Samuel's candidacy, told Fraenkel in August that the recommendations of Franck, Born, and Raman should suffice. Concerning Ornstein's highly negative opinion, Einstein stated that "it is irrelevant, to my mind. Firstly, he does not know Samuel. Secondly, I know him [Ornstein] as an egocentric person who strives for power and influence at any cost, and who tends to defame in order to advance his own men."[70] Ornstein in fact again wrote another detailed letter to Fraenkel, arguing against Samuel: "Nowadays there is no place for three experimenters, and of all – Wolfson . . . is better than Samuel. The physics department is lacking a theoretician."[71]

Correspondence pertaining to the Samuel affair continued. Weizmann suspected that it was Sambursky who was organizing the opposition to Samuel, and who was negatively influencing Schocken.[72] Fraenkel also wrote to Erna Samuel, who was living in Haifa, and her responses convey a sense of sadness and despair. She writes, for example, of Schocken's "despairing" proposal to appoint her husband as a propagandist and fund-raiser for the university. Weizmann, as we saw, strove valiantly to support the nomination of Samuel. In December 1936, at a meeting of the faculty board, Weizmann again tried to advance Samuel's appointment, saying "it is unhealthy for Sambursky to want to monopolize himself in experimental physics."[73]

Samuel's disappointment with his treatment by the Hebrew University did not diminish his ambition to realize his dream of Zionism, which he had nurtured since his youth. In a note written to Fraenkel from London, he wrote: "I have decided for Palestine at any price, even at the risk of abandoning physics. Thus only one member of the family will be hurt, and not all three."[74] It seems that in the end Samuel went to the Haifa Technion. His status there is unclear. He published some papers dealing with the chemical bond that were written at the Technion, but were based in part on a series of lectures he had given at the Technological Institute of Illinois in Chicago in 1943.[75] He died in 1949 at the age of 52 in Tel-Aviv.[76]

Fritz London: "A Complete Jew?"

Fritz London (1900–1954) was an outstanding physicist of the first half of this century. He was born in Breslau, Germany, into an assimilated Jewish family and started his academic career in philosophy. His work in physics reflected his deep philosophical tendencies. In 1927 his and Walter Heitler's paper on the quantum-mechanical treatment of the hydrogen molecule was a cornerstone of quantum chemistry. In 1939, jointly with Edmond Bauer, he published an important mono-

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graph on the theory of measurement in quantum mechanics, which is still cited today as a basic work on quantum theory. He made another monumental contribution to modern physics by laying the foundation for understanding superconductivity and superfluidity.[77]

In the summer of 1936, a special report was prepared for a meeting of the Board of Governors,[78] wherein the Senate's decision concerning the order of priorities to be adopted in developing the faculty was stated: theoretical physics stood at the top of the order of priorities, and a budget of 950 P was allotted to it for a professor's salary, a senior assistant's salary, and the acquisition of books. After Wigner's candidacy did not materialize, Fraenkel consulted Einstein regarding possible candidates for theoretical physics, mentioning the names of two physicists from Poland, M. Mathison and L. Infeld, and also L. Goldstein from Paris. Concerning London, Fraenkel commented: "it seems to us we shall have to dispense with Dr. London, because by his behavior he does not belong to Judaism . . . ."[79]

Einstein responded to Fraenkel's proposed candidates and added his own.[80] Earlier, however, London's Jewishness came up again more resolutely in a letter that Fraenkel wrote to Josef Cohen, Weizmann's secretary: "It is accepted in Jerusalem that Dr. London is not Jewish, and therefore his candidacy has to be given up."[81] Now Einstein, in a second letter to Fraenkel dealing specifically with London, informed Fraenkel that "Just now Prof. [Karl] Herzfeld informs me that Dr. London (now in Oxford) is fully Jewish [*Volljude*], and even a Zionist. He has important scientific achievements, and he is to be considered – if Herzfeld's facts are indeed correct – as a candidate of the first order."[82] Fraenkel, seemingly before Einstein's second letter reached him, submitted a report on the state of affairs in theoretical physics to Weizmann, in which he mentioned Lothar Nordheim (Einstein's proposal) and Rudolf Peierls (Ornstein's proposal), but does not mention London.[83] However, at the end of July 1936 Fraenkel responded to Einstein's second letter concerning "the full Jewishness" of London, as follows:

> I received your letter, which has changed the situation (the candidates Louis Goldstein and maybe [Cornelius] Lanczos [Einstein's second proposal] – if he is Jewish and takes an interest in Palestine – remain as they were). As to Nordheim and London. The first according to Herzfeld is half Jewish and converted to Christianity, and therefore is out of the game. I could not guess this from your letter. Regarding London I made inquiries with London's people and found: 1) he has been reared as a Christian since birth (and been baptized). He supports, however, matters Jewish and Zionist. 2) that he is not available at present, and neither in the foreseeable future, as he has an appointment for a year in Paris which almost certainly will turn into permanency. After three failures (Placzek, Bloch, Wigner) it is undesirable to push his candidacy at present. Concerning Heitler, whom you mentioned, his position in Bristol is very promising and I suppose he will not want to come to Palestine. I shall keep track of him. Your opinion in matter L. Goldstein will be very valuable, and particularly – if it will reach Zurich before 23.8.1936 [August 23, 1936]. Hoping you are not put out by all this bother, and with sincere thanks . . . .[84]

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Einstein responded that although he did not know Goldstein or his work, he trusted the testimonies of Louis de Broglie (Nobel Prize 1929) and the mathematician Jacques Hadamard, if they were positive and without reservations. In October 1936 Fraenkel gave a comprehensive report to Einstein: "the candidates are: 1) London, 2) Louis Goldstein. We are aware of London's being in an altogether different class than Goldstein. There are those claiming that if we should not reach agreement with somebody of London's caliber, we should give up filling the position altogether, at this stage .... We shall explore the matter of London, therefore, who in the meantime received a promising appointment in Paris. We shall do this carefully, and by private inquiries in order to protect ourselves from a rejection of an official proposal as has happened with Placzek, Bloch, and Wigner. Should he respond positively, we shall put the proposal before the academic leadership whose agreement – in light of London's attitude towards Judaism – is not a priori certain."[85]

Fraenkel's "inquiries" included one to Rudolf Samuel, who recommended London warmly; he had come to know London well. For example, he had worked with him in England, and said that except for Born, no candidate was equal to London.[86] Fraenkel also approached Samuel's wife Erna in Haifa to get more personal information about London. Her opinion – which was far from unemotional – was much less flattering:

> L is an assimilated Jew [*Assimilationsjude*] who was not baptized, belonged to a so-called "parithetical" society, married to a Zionist. My husband regards him as an intelligent co-worker, dependable with good knowledge but not very productive if working alone. Born did not have much good to say about him when he visited India, but changed his mind after discussions with L. On his personal attributes, I prefer to talk with you. Please, do not show this letter to anybody. It was very difficult for me to write it. His [London's] financial situation is at present most pitiful. It is difficult for me to keep my personal feelings apart from the interests of the Hebrew University.[87]

One wonders whether Mrs. Samuel's words were not influenced by her fervent desire to advance, above all else, her husband's cause.

At the aforementioned meeting of the faculty board in December 1936, Fraenkel reported that London was positively inclined towards the offer of a chair in Jerusalem. Weizmann then raised the question "whether it would not be possible to attract [*zu gewinnen*] Einstein in some way. This would be more feasible now, after his wife's death. Just in today's general conditions Einstein's joining would constitute a tremendous strengthening of the morale of the Jewish population in Palestine [the 'Yischuw']." The board decided that Weizmann should write to Einstein on this question.

The following month, at the end of January 1937, Fraenkel received a letter from London in Paris (figure 15), containing a polite rejection of the overtures made to him: "my position here, which has been most temporary, became permanent .... Although my inclinations towards Palestine did not, as a result, change fundamentally, I have a commitment towards the physicists here ...."[88] Fraenkel subsequently met with London in Paris, after which London gave Fraenkel detailed

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Fig. 15. Fritz London in Paris, 1936. Courtesy of Frank London.

reasons for his refusal. He justified it by his desire to encourage the inclinations of the French to aid Jewish intellectuals: "If the first [candidate] they really want [to keep in France] were to leave, it would have a negative influence on these inclinations."[89] Weizmann reacted angrily, feeling personally insulted, which reinforced his negative attitude towards scientists from Germany. Retracting his earlier offer, he refused to allow the Sieff (later Weizmann) Institute to participate in funding London's visit to the country, should it take place.[90] Later, Weizmann relented and allowed London to visit in the spring of 1938, in the hope of changing London's mind. London took part in the Passover night celebration at Fraenkel's home and suffered from the length of the occasion.[91] The visit, after all, did not change London's preference for the United States over Palestine, and in May of 1938 he was appointed professor at Duke University in Durham, North Carolina,[92] where he remained until his death in 1954.

Nevertheless, efforts to bring London to Jerusalem continued in 1938, all to no avail. Concurrently, Mathison's and Infeld's candidacies were again considered.[93] Moreover, in early 1938 a letter reached Weizmann suggesting the possibility of obtaining James Franck (b. 1884, Nobel Prize 1925) for the Hebrew University, but this possibility was not pursued: Franck remained at The Johns Hopkins University

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in Baltimore. Thus, by 1938 the state of physics at the Hebrew University remained unchanged. There was no professor of theoretical physics, and the "teaching of physics remained fragmentary."[94]

An Improvised Solution: Menachem (Max) Schiffer

The pressing need of the physics department to appoint lecturers led to improvised solutions. One of the more successful ones centered on a young assistant who aspired to a doctorate in the department of mathematics, and who was appointed to teach physics. Menachem (Max) Schiffer (b. 1911) had studied at the University of Berlin from 1930 to 1933, then immigrated to Jerusalem, where he was awarded the M.A. degree in 1934. He was a brilliant student and outstanding teacher, so in October 1935 he was asked to teach the course of analytical mechanics in the physics department, with Sambursky taking academic responsibility for it. Schiffer also served as librarian in the physics and mathematics library, and he contributed to experimental research in physics and physical chemistry as "resident theoretician." Schiffer's physics teaching, which soon included courses in electricity and quantum mechanics, continued for many years.

After completing his doctorate in mathematics under Fekete, Schiffer received an official appointment as "temporary assistant in theoretical physics" on March 1, 1939. In January 1942 Racah (see below) recommended his appointment as instructor in the physics department, because Racah felt himself unable to fulfill all of the teaching duties in theoretical physics. He stated in a letter to the university board: "I am unable to give the students a comprehensive course of the wide and widening range of physics, and I need a permanent assistant authorized to teach independently." He also mentioned that Farkas had taken upon himself the teaching of thermodynamics.[95] Racah's request was denied, and a year later he reiterated his request more forcefully: "I cannot cope . . . , in spite of giving the highest number of lectures of all lecturers (7 lectures and a seminar), such as thermodynamics and elasticity, I do not demand 3 chairs as there were in Pisa and Rome. Dr. Schiffer has served already 4 years as temporary assistant. I hope this justified demand will not be turned down this time."[96]

This time Schiffer's appointment as instructor in theoretical physics was confirmed as of October 1, 1943. In 1947 he was promoted to lecturer, and in 1949 to professor. He then returned to his field of applied mathematics. Later he moved to the United States, where he made a brilliant career at Princeton University (1949–1950) and as Head of the Applied Mathematics Department at Stanford University from 1953 until his retirement in 1976.

Successful Conclusion: Giulio Racah

The difficult and tortuous process of finding a theoretical physicist of stature for the department of physics at the Hebrew University was successfully concluded with the appointment of Giulio Racah (1909–1965).

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On November 14, 1938, Weizmann in London received a short letter from Giulio Racah in Florence.[97] Racah wrote: "It has come to my knowledge that the Hebrew University is looking for a theoretical physicist. It will be a great honor to lecture at our university. Enclosed – a curriculum vitae. With appreciation-Giulio Racah." Virtually simultaneously, Dr. Umberto Nahon, one of the leaders of Italian Jewry, sent a short letter of recommendation from Milan: "From a Jewish and Zionist viewpoint, he is one of the best candidates imaginable."[98] Nahon also talked to Weizmann in Paris about Racah's candidacy, and later sent him another letter.[99] There is a hand-written note on this letter (Weizmann's, most probably) in English (the letter itself is in French): "He is a rich man, I understand." Everything seemed positive: Racah was a Jew, Zionist, rich, and most important, he wanted, actually desired, to come to Jerusalem to the Hebrew University.[100]

Giulio Racah was born in Florence, Italy, the son of a noble and ancient family: his father, Adriano, was an engineer and doctor of naval law; his mother, Pia, was a member of the Fano family, which according to tradition had arrived in Italy at the time of the Second Temple. Racah received his doctorate in physics from the University of Florence in 1930. During the 1930s physics flourished in Italy. A brilliant group of young researchers were attracted to the University of Rome by Enrico Fermi. Racah was Fermi's assistant in Rome for a year, and then spent a year with Wolfgang Pauli in Zurich. He began teaching theoretical physics at the Universities of Florence and Pisa, and in 1937, after winning a national competition, was appointed extraordinary professor at the University of Pisa, becoming one of the youngest professors in Italy at that time.

Racah became a member of the Jewish community in 1931, and two years later joined the Zionist federation. He visited Palestine in 1934. His national awareness ripened, so that when the Italian racial laws were passed in 1938 and he was dismissed from his position in Pisa, it was natural for him to offer his candidacy to the Hebrew University.

In January 1939, Racah met Weizmann in London. In later years, Racah would tell the following story about this meeting: "When I met Weizmann my mind was already made up to emigrate from Italy to Palestine. The question I put to him was whether to go there as a scientist or as a pioneer. He answered at once: 'As a pioneer in science'."[101] Prior to this meeting, Racah met with Werner Senator, the administrator of the university, in Trieste. This meeting was for the purpose of inquiring into Racah's origins, Jewishness, knowledge of Hebrew, family status, and scientific connections.[102]

In February 1939 Racah discovered that the man to further his interests at the university was Fraenkel, so he turned to him, writing a letter to him in German, wherein he recalled the nice Sabbath eve he spent in Fraenkel's home on his visit to Jerusalem several years earlier. "I shall tell you frankly that I yearn [*mich danach sehne*] to contribute my scientific activity to our university. To my regret I know only French and German. I shall, of course, see to it to learn our language with all possible speed."[103] During the coming months feverish efforts were undertaken to obtain entry visas to Palestine for Racah and his mother Pia – no simple task in those days.

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In August and September of 1939, letters of recommendation for Racah were received from Wolfgang Pauli (Zurich), Niels Bohr (Copenhagen), Enrico Fermi (now in New York), Hendrik Anton Kramers (Leiden), and in November also from Fritz London (Durham, North Carolina). Pauli wrote:

> I know him personally, and know his works well. An extraordinary mathematical talent, and in perfect command in any problems and methods of modern theoretical physics (wave mechanics and quantum electrodynamics) . . . . He succeeded in solving problems which deterred others (the creation of pairs as a result of the collision of fast charged particles with atoms), and also the computation of the radiation of very fast particles . . . , problems which are at the core of the most modern theories of cosmic rays . . . and therefore he is qualified also to cooperate with an experimental research institute. He is also extraordinarily conversant with questions of principle . . . . In conclusion, I do not know a candidate more suitable for a professorship in theoretical physics in Jerusalem than Prof. Racah. As regards [Reinhold] Fürth (Prague) [who also was under consideration], he is undoubtedly a good craftsman particularly in the area of Brownian motion, but he is less original, and of weaker attitude to modern physics.[104]

Bohr's recommendation was brief: he expressed his high esteem for the scientific work of Fürth and Racah, but refrained from comparing them.[105] By contrast, Fermi dealt only with Racah and wrote:

> Of the candidates you mentioned I can provide information only on Prof. Racah. I knew him very well because . . . he worked with me for some time in Rome. I could therefore appreciate [his] outstanding knowledge of physics, and could follow very closely his interest in scientific work. His contributions to the quantum theory of radiation are particularly valuable. I have to mention that he arrived independently and almost simultaneously with Bethe and Heitler at the same results concerning the emission of radiation by high-energy electrons. May I be allowed to add, that in my opinion Racah possesses all the personal attributes to lead most effectively young students in scientific work.[106]

And Kramers wrote: "Prof. Fürth is older and more impressive; Prof. Racah is very good in quantum physics, and certainly most promising; I do not know how broad he is because I do not know him personally that well. Although Fürth did solid work in physics, my impression is that he is less sophisticated than Racah. As I see sophistication as a very great gift, I personally would prefer Racah. Particularly a young university like Jerusalem should, besides considering the present, look forwards seriously towards the future, and this, too, is a point in Racah's favor. I am, however, aware that such an argument is quite hard on Prof. Fürth . . . . "[107]

The committee on theoretical physics then convened in the middle of October 1939 to consider the appointment, in the presence of Fraenkel, Fekete, and Sambursky, and in the absence of Farkas. The committee decided that Racah, the expert in quantum theory, was preferable to Fürth: Racah was younger, would learn Hebrew rapidly, and would be productive for a long time in the future. The committee therefore recommended his appointment. The report of the committee

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was submitted to the Senate, who assembled for a meeting on October 17, 1939. At this meeting Fraenkel reported in detail on the negotiations that had taken place with the various candidates, the material collected on them, and on his consultation with Einstein. Sambursky added further positive information on Racah from both scientific and personal viewpoints. At the end of the meeting a secret vote was taken on Racah's appointment with the result: 19 for, 4 against. The Executive Committee endorsed Racah's appointment on October 30, 1939.

There was much joy over the successful filling of the chair for theoretical physics, as is evident from Fraenkel's letters to Einstein and Weizmann. In early November, Fraenkel wrote to Einstein in English (to avoid delay owing to censorship): "You will certainly be interested as well as glad to know that we have eventually succeeded in finding an occupant for the chair of theoretical physics."[108] It seems that the advice to request an opinion from Pauli was Einstein's, while that to request opinions from Kramers, Bohr, and Fermi – was Ornstein's. Fraenkel concluded his letter by thanking Einstein for his help in this complicated project over the years: "I can remember corresponding between you and me about this point as early as 1930," wrote Fraenkel. His letter to Weizmann also concluded with a sigh of relief, that "after so many disappointing efforts during six years we finally succeeded, at last."[109]

On November 18, 1939, Racah informed Werner Senator that he gratefully accepted the appointment.[110] In February 1940, at a session of the Senate, Rector Fraenkel reported that, "Prof. Racah has arrived in the country."[111] It is stunning to discover in this connection that Racah's salary, which was paid from April 1, 1940, was "half the salary of a refugee professor": 15 P per month. The university cynically exploited Racah's sound financial situation, and his willingness to apply for the position. The University, it seems, had good reason to rejoice over Racah's appointment.

In July 1940, Racah sent a note to the rector of the university, Fraenkel, asking to be accepted into the Senate, because "I think my knowledge of Hebrew is sufficient to follow the deliberations."[112] This was expedited, as already at the Senate meeting on July 22, Racah's name appears on the list of those present. The first item on the agenda was the confirmation of the curriculum for physics as a major subject. Physics at last occupied its rightful place in the university. Fraenkel eventually included in his résumé as rector of the university, and in a report on his achievements, the acquisition of Racah and the transformation of physics into a major subject in the university.

Racah's scientific work, which he began the moment he arrived in Jerusalem, was accomplished in complete seclusion, as World War II was raging. Nonetheless, the papers he published, under the general heading of "Theory of Complex Spectra,"[113] became classics in theoretical quantum physics. His second article in this series appeared on the list of the ten most quoted articles during the years 1945–1955. This paper laid the groundwork for what is known today as "Racah Algebra," and it abounds with original ideas and amazing calculations. It also was included in a special volume that appeared in 1995 of a collection of the 200 most important articles published during the first one hundred years of *The Physical Review*.[114] Calculations in atomic physics, nuclear physics, and elementary-particle physics, cannot be performed without using Racah's methods.

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Giulio Racah elevated the Hebrew University to the world stage of physics (figure 16). As an outstanding researcher and an inspired teacher, Racah tutored and nurtured dozens of physicists who over the years became founders of physics departments all over Israel, and indeed the world. Within a short time, he became one of the pillars of strength of the Hebrew University, eventually becoming head of the professors' association, dean of the faculty of science, and in 1961 rector of the university and acting president. Shortly after finishing his turn as rector, at the end of 1965, he was killed in an accident in his native city of Florence.

Conclusions

The development of research and the teaching in physics at the young Hebrew University in Jerusalem is a fascinating and surprising story precisely because it is interlaced and entangled with human, ideological, and financial viewpoints. The conflict between the Zionist ideals of Chaim Weizmann, Albert Einstein, and Abraham Ha'levi Fraenkel on the one side, and those of Jehuda Leib Magnes and his supporters on the other, is ever present. Weizmann, Einstein, and Fraenkel saw the natural sciences as an indispensable foundation for the establishment and consolidation of a modern Jewish state. Magnes and his supporters did not ascribe great importance to the natural sciences and allotted to them minimal resources, treating them as a "step-child," in Fraenkel's words.

The question of who was a good Jew, and who was a better Jew, was a handicap for outstanding physicists whose candidacies were considered seriously. Everyone referred to this question, orally and in correspondence – some willingly, and some for lack of choice!

Fig. 16. Chaim Weizmann (left) and Giulio Racah (then Dean of the Faculty of Science) after the ceremony of conferring an Honorary Degree on Weizmann and Magnes, July 7, 1947. Courtesy of the Hebrew University Archive.

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The Hebrew language, as the sole language of instruction, erected a barrier between the university and some serious candidates. They did not disagree openly with the demand to teach in Hebrew, but there is no doubt that it diminished their enthusiasm for the appointment. Hints of this can be found in the experiences of Placzek, Bloch, Wigner, and London – all of whom made seminal contributions to twentieth-century physics. In retrospect, it appears that willingness to acquire the Hebrew language was the most important test of the sincerity of the candidates' aspirations to be included as faculty in the Hebrew University.

During the quest for an eminent physicist to occupy the chair of theoretical physics at the Hebrew University, numerous candidates with international reputations were proposed. The list of names of the candidates and their sponsors reads like a "Who's Who" in physics in the first half of the twentieth century. This list is a wondrous testimony to the ideals and faith of those who were committed to making the Hebrew University into an international scientific center of the highest standard. Chief among these was Chaim Weizmann, who was principally responsible for making Israeli science preeminent in the world today. However, without the dedication of his aides, particularly Abraham Ha'levi Fraenkel, it is doubtful that Israeli mathematics and physics would have achieved this high position.

There was great audacity in supposing that a university that had just arisen from a cultural and scientific wilderness could attract outstanding people. We have seen, indeed, that idealism, audacity, and tenacity were insufficient; resources also were needed: well-equipped laboratories, good libraries, and competitive salaries. For many years the leadership of the Hebrew University was not inspired by scientific idealism, and allocated funds that were insufficient to compete with American universities. As a result, some of the high hopes of the scientists, during the first decades of existence of the Hebrew University, ended in disappointment.

To overcome these obstacles, candidates for the chair of theoretical physics required Zionistic enthusiasm and fierce determination. That, however, was still insufficient, as we have seen in the case of Rudolf Samuel, who was a wholehearted Zionist. He was not accepted because he did not meet the scientific expectations of the physicists already at the university. They also feared that, as an experimenter, Samuel would encroach upon their own laboratories, and consequently various negative evaluations of his scientific abilities and achievements were used to reject him.

Giulio Racah proved that he was possessed of a different mettle. Isolation from centers of science did not prevent him from making his great scientific achievements. As an outstanding physicist and Zionist Jew of strong character, he overcame hesitations of the university leaders, difficulties of language, and settlement in a distant and different country. His unique character – his great talent and deep understanding, his enormous willpower, his ability to persevere in long and complicated calculations without having another physicist nearby to confer with or rejoice in his results – was central to his scientific achievements. With Racah's appointment, the Hebrew University and the State of Israel-to-be joined the honorable family of recognized centers of physics in the world.

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Acknowledgments

A Hebrew version of this paper was published in Shaul Katz and Michael Heyd, ed., "The History of the Hebrew University of Jerusalem, Origins and Beginnings" [In Hebrew] (Jerusalem: The Magnes Press, The Hebrew University of Jerusalem, 1997), pp. 589–624, and I am grateful to The Magnes Press for permission to publish this English version here.

Thanks are due to Dr. Shaul Katz who brought me close to the subject, and helped by providing encouragement and sources throughout the task. I am grateful to Roger H. Stuewer who did magic with his careful editorial work. Thanks to Evdokia Alagem, head of the Hebrew University archives, and Ze'ev Rosenkranz, curator of the Einstein archives, who found the sources essential to this work and gave their wholehearted assistance at any time. Thanks to Carla and Nissan Zeldes for their important help; my thanks to Joseph Norel for translating and to Irene Coster for her great help with the final version of this article.

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15 Haber to Einstein, undated, *ibid.*
16 Weizmann to Magnes, September 5, 1933, in G. Sheffer, ed., *The Letters and Papers of Chaim Weizmann*, Vol. XVI (New Brunswick, N.J. and Jerusalem: Transaction Books, Rutgers University and Israel Universities Press, 1978), p. 45.
17 H. Lavsky, *Before Catastrophe* (Jerusalem and Detroit: The Magnes Press and Wayne State University Press, 1996), pp. 52, 108.
18 Brodetsky to Ornstein, August 3, 1933, UA.
19 Ornstein to Magnes, March 18, 1934, UA, file Placzek.
20 See David C. Cassidy, "Placzek, George," in Frederic L. Holmes, ed., *Dictionary of Scientific Biography*, **18** (New York: Scribner's 1981), pp. 714–715; Otto R. Frisch, *What Little I Remember* (Cambridge: Cambridge University Press, 1979); Abraham Pais, *Niels Bohr's Times, in Physics, Philosophy and Polity* (Oxford: Clarendon Press, 1991); Richard Rhodes, *The Making of the Atomic Bomb* (New York: Simon and Schuster, 1986); Roger H. Stuewer, "Bringing the News of Fission to America," *Physics Today* **38** (October 1985), p. 49; Obituaries by Edoardo Amaldi, Leon Van Hove, Victor F. Weisskopf, Emilio Segre, R. E. Peierls, all cited in Poggendorff, Vol. VIIb (Berlin: Akademie Verlag, 1980), pp. 4040–4041.
21 G. Placzek and E. Teller, "Die Rotationsstruktur der Ramanbanden mehratomiger Moleküle," *Zeitschrift für Physik* **81** (1933), 209–258.
22 E. Amaldi and G. Placzek, "Über das Ramanspektrum des gasförmigen Ammoniaks," *ibid.*, pp. 259–269.
23 Sambursky to Magnes, June 18, 1934, UA, file Placzek.
24 Ornstein to Placzek, August 20, 1934, i*bid.*
25 Fekete to Magnes October 21, 1934, *ibid.*
26 The first approach to Felix Bloch proposing a nomination to the university was rejected in 1933. In 1935 negotiations with him were resumed; see UA, files 1935, 1936.
27 Ornstein to Magnes, October 26, 1934, UA, file Placzek.
28 Schocken to Schloessinger, January 15, 1935, *ibid.*
29 Magnes's Protocol of May 22, 1935, *ibid.*
30 Ginzberg to Magnes, May 30, 1935, *ibid.*
31 Note from Schloessinger to Magnes, June 3, 1935, *ibid.*
32 The details of the budget: "20,000 P building and equipment; 3,500 P running expenses; 500 P rental of a source of Radium; 1,000 P routine acquirements; 2,000 P salaries for 4–5 assistants and 2–3 helpers"; *ibid.*
33 Magnes to Schloessinger and Schocken, June 10, 1935, *ibid.*
34 Schocken to Magnes, June 14, 1935, *ibid.*
35 Magnes's memorandum, July 11, 1935, *ibid.*
36 Frisch, *What Little* (ref. 20), p. 83.
37 Stuewer, "News" (ref. 20).
38 The following documents can be found in the University Archives, file 1936: letter from Magnes to Ornstein, August 30, 1933; telegram from Ornstein to Magnes, September 6, 1933; letter from Ornstein to Magnes, September 14, 1933. In this last letter Bloch is quoted: "Bloch was surprised by the offer of a two-year appointment. Until now only a visit of a few weeks was mentioned, to acquaint himself with the conditions, and this still, it seems to him, is a prerequisite essential to the matter." Ornstein proposes to invite him to lecture for a period of three months, and after that to enable him to decide whether to stay. Telegram from Bloch to Magnes September 16, 1933: "A decision is not yet possible." Letter from Magnes to Ornstein, September 28, 1933: "There are no funds for a short visit. A series of lectures is useless. There is the problem of language. We do not know what to offer him as we want him very much." Letter from Ornstein to Magnes, December 25, 1933: "His [Bloch's] work warrants a professorship, he is absolutely first-class. He will also be very helpful in the development of experimental physics . . . . "
39 Bloch to Magnes, January 17, 1934: "Just now your letter of 11.1.1934 [January 11, 1934] has arrived, and I hasten to answer. Regardless my deep gratitude for your offering me the chance of a professorship with a higher salary, I have to inform you that, to my regret, I cannot accept your offer, at least in the near future . . . . I accepted an urgent offer of a professorship from Stanford

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University. Considering the preferred material and scientific conditions there, I could not refuse . . . . It is difficult for me to tell you how saddening for me the fact is that the possibility of co-operation with the Hebrew University has been prevented. I shall only express my hope to be able to put my abilities at its disposal . . . . " Letter from Ornstein to Magnes, February 6, 1934: "It is most unfortunate we lost him, it was a mistake to save money on someone like him . . . . " UA, file 1936.

40 Bloch to Magnes, July 18, 1935; Magnes's answer to Bloch, July 23,1935, *ibid.*
41 Magnes to Ornstein, July 15, 1935, FA, JNUL.
42 Ladislau Farkas, head of the physical chemistry department, candidate for professorship; see Chayut, "Berlin to Jerusalem" (ref. 1).
43 Fraenkel to the secretariat, July 29, 1935, UA, file 1936.
44 Summary of meeting with Bloch on August 31, 1935, in Zurich, recorded by Fekete in Lucerne on September 12, 1935, *ibid.*
45 Fraenkel to Weizmann, October 24, 1935, FA, JNUL.
46 On this committee, and its conclusions, see Parzen, *Hebrew University* (ref. 4), pp. 35–64.
47 Protocols of the meetings of the council of the faculty of science, 1935, UA and FA, JNUL.
48 At least 1,500 P will be needed during the year. In addition, the most urgent funding is for an air liquefier (600 P); 1935, *ibid.*
49 Subject matter for the executive meeting of December 26, 1935 (prepared on December 22, 1935). In this subject matter the financial problems are detailed: in the budget for German refugees only 400 P are left. Bloch's demands for a higher salary and a scientific assistant (instead of a laboratory assistant) are going to add 250 P to the allotted salaries. In addition, an amount (50–100 P) has to be allotted to the library. FA, JNUL.
50 Ben-David to Weizmann, January 10, 1936, *ibid.*
51 Bergmann to Einstein, February 9, 1936, EA, JNUL.
52 Einstein to Fraenkel, February 23, 1936, *ibid.*
53 Telegram from the university to Bloch, February 21, 1936, UA, file 1936.
54 Telegram from Bloch to the university, February 26, 1936, *ibid.*
55 The report, prepared by Fraenkel in June 1936, was written in German. FA, JNUL.
56 E. Vogt, "Eugene Paul Wigner: A Towering Figure of Modern Physics," *Physics Today* **48** (December 1995), p. 40.
57 L. Farkas and E. Wigner, "Calculation of the rate of elementary reactions of light and heavy Hydrogen," *Trans. Faraday Soc.* **32** (1936), 708–723. See also the Farkas Archive, JNUL.
58 Fraenkel to Weizmann, March 12, 1936, FA, JNUL.
59 The following correspondence can be found in the University Archives, file 1936: cable from Fraenkel to Wigner, March 6, 1936; cable from Wigner to Fraenkel, March 7, 1936; cable from the university to Wigner, March, 12, 1936; cable from Wigner to the university, March 13, 1936; letter from the university to Wigner, March 19, 1936; letter from Wigner to Fraenkel, March 30, 1936 (following a cable of the same day); cables from the university and Fraenkel to Wigner, May 10, 1936.
60 Protocol of the meeting of the faculty board, May 5, 1936, FA, JNUL.
61 Fraenkel report of 1936, (ref. 55).
62 Fraenkel to Einstein, June 18, 1936, EA, JNUL.
63 Fraenkel to Cohen, June 18, 1936, FA, JNUL.
64 Wigner to Fraenkel, July 2, 1936, *ibid.*
98 Nahon to Weizmann, November 10, 1938, *ibid.*
99 Nahon to Weizmann, November 16, 1938, *ibid.*
65 Sir C. V. Raman to the rector of the university, April 22, 1936, UA, file 1936. Perusal of Samuel's publications from 1924–1936 show the themes of his research to be experimental molecular spectroscopy, absorption and emission spectra, Raman scattering, and photo-dissociation of various substances.
66 Fraenkel to Samuel, February 17, 1936, FA, JNUL.
67 Ornstein to Weizmann, March 3, 1936, *ibid.*
68 Samuel to Fraenkel, March 10, 1936, *ibid.*
69 Samuel to Koebner, July 29, 1936, *ibid.* (R. M. Koebner's name appears in Fraenkel's handwriting at the head of the plan's copy.)
70 Einstein to Fraenkel, August 10, 1936, EA, JNUL.

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71 Ornstein to Fraenkel, August 16, 1936, FA, JNUL.
72 Cohen (Weizmann's secretary) to Fraenkel, October 27, 1936, *ibid.*
73 Protocol from the meeting of the faculty board, December 31, 1936, *ibid.*
74 Samuel to Fraenkel, no date, hand-written in German, on official notepaper of the Aligarh Islamic University, *ibid.*
75 R. Samuel, "Molecular Constants and Chemical Theories, I, II, III," *Journal of Chemical Physics* **12** (1944), 167–179, 180–204, 380–390.
76 A brief eulogy was published the next day, February 5, 1949, in *The New York Times*.
77 London was the first to understand that a purely theoretical idea (Bose-Einstein condensation), which stems from statistical quantum mechanics, is linked to these phenomena. During the last years of his life two volumes on these subjects written by him were published in the U.S.; his first book, on the molecular theory, was not published because Springer publishers broke the contract soon after its signing, at the beginning of 1933. See C. W. F. Everitt and W. M. Fairbank, "London, Fritz," in Charles Coulston Gillispie, ed., *Dictionary of Scientific Biography*, **8** (New York: Scribner's, 1973), pp. 473–479; a comprehensive scientific biography of him was published recently by Kostas Gavroglu, *Fritz London: A Scientific Biography* (Cambridge: Cambridge University Press, 1995).
78 The report was sent to Fraenkel by the Academic Secretary, S. Ginzberg, July 22, 1936, FA, JNUL.
79 Fraenkel to Einstein (ref. 62).
80 Einstein to Fraenkel, July 2, 1936, EA, JNUL. In this letter, Einstein makes additional proposals: L. W. Nordheim and C. Lanczos. He reacts to the names mentioned by Fraenkel: Goldstein he does not know. Mathison is a good physicist, but not extraordinary. Apart from this he has a good position in Russia, and it would be wrong to get him to leave when there are excellent unemployed physicists. Mathison, whose field was the general theory of relativity and pure mathematics, was still a candidate a year later, and Posnanski met him in Warsaw (June 13, 1937) and was enthusiastic, but there was nothing further.
81 Fraenkel to Cohen, June 18, 1936, FA, JNUL.
82 Einstein to Fraenkel, July 21, 1936, EA, JNUL.
83 Fraenkel to Weizmann, July 27, 1936, FA, JNUL.
84 Fraenkel to Einstein, July 31, 1936, EA, JNUL. As to Einstein's reaction, see ref. 70.
85 Fraenkel to Einstein, October 19, 1936, *ibid.*
86 Samuel to Fraenkel, December 1, 1936, FA, JNUL.
87 Erna Samuel to Fraenkel, December 14, 1936, *ibid.*
88 London to Fraenkel, January 28, 1937, *ibid.*
89 London to Fraenkel, February 13, 1937, *ibid.*
90 Cohen to Fraenkel, March 8, 1937, *ibid.*
91 Gavroglu, in his biography (ref. 77), tells about this and adds that Weizmann joked later that Passover night at Fraenkel's drove London from the country for good.
92 London to Fraenkel, May 1, 1938, FA, JNUL.
93 Einstein to Schocken, April 28, 1937, EA, JNUL, and see refs. 62, 79.
94 Report of the chairman of the university executive for the year 1936–1937, FA, JNUL.
95 Racah to the university board, January 20, 1942, UA, file Schiffer.
96 Racah to the university board, January 26, 1943, *ibid.*
97 Racah to Weizmann, November 14, 1938, UA, file Racah.
98 Nahon to Weizmann, November 10, 1938, *ibid.*
99 Nahon to Weizmann, November 16, 1938, *ibid.*
100 At the same time the candidacy of Reinhold Fürth from Prague was also brought up, and Einstein in his letter to Fraenkel (December 2, 1938, EA, JNUL) compares him to Mathison. Regardless of not having recommended Mathison in the past, he now recommends to prefer him to Fürth. He emphasizes that all his thoughts are bent on rescuing refugee physicists, and both are refugees!
101 G. Racah, "Wider Horizons," *Rehovoth* **2, 3** (1963), p. 8.
102 An interesting protocol (hand-written) of this meeting is to be found in the UA, file Racah.
103 Racah to Fraenkel, February 28, 1938, *ibid.*
104 Pauli to Fraenkel, August 4, 1939, *ibid.* On Fürth, see ref. 100.

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105 Bohr to Fraenkel, September 7, 1939, *ibid.*
106 Fermi to Fraenkel, September 8, 1939, *ibid.*
107 Kramers to Fraenkel, September 15, 1939, *ibid.*
108 Fraenkel to Einstein, November 6, 1939, EA, JNUL.
109 Fraenkel to Weizmann, November 6, 1939, *ibid.*
110 Racah to Senator, November 18, 1939, UA, file Racah.
111 Protocol of the Senate session, February 7, 1940, FA, JNUL.
112 Note in Racah's handwriting, July 7, 1940, UA, file Racah.
113 G. Racah, "Theory of Complex Spectra. I," *Physical Review* **61** (1942) 186–197; "II," **62** (1942), 438–462; "III," **63** (1943), 367–382; "IV," **76** (1949), 1352–1356.
114 H. Henry Stroke, ed., *The Physical Review: The First Hundred Years: A Selection of Seminal Papers and Commentaries* (Woodbury, New York: American Institute of Physics Press, 1995); Racah's paper, "Theory of Complex Spectra. I," appears on pages 136–147. Hans A. Bethe's critical review of this volume, which appeared in *Physics Today* **48** (November 1995), 177, particularly points to Racah's article: "this article provides everything a theoretician needs for his work on the subject [Complex Spectra]."

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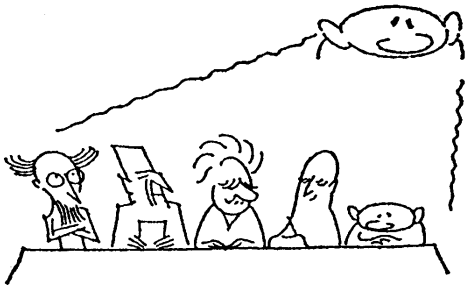

THE ARITHMETIC OF CO-OPERATION

When you're adding up committees
there's a useful rule of thumb:
that talents make a difference,
but follies make a sum.

Piet Hein

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