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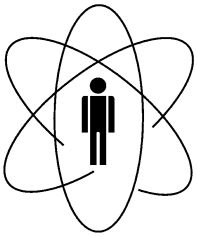

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On the "Missing Letter" to Lattes and the Nobel Prize in Physics

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Abstract: We briefly discuss the myth of a possible missing letter from Bohr to Lattes and show the only content of the Bohr archives concerning the Brazilian physicist. We also analyze and discuss the Nobel Prize in Physics Nominations and Nominees from 1901 to 1963. For example, the highest number of nominations (considering data up to the year of the Nobel Prize) was received by Otto Stern, with a total of 82 nominations. It was found that the average number of nominations per Nobel Prize awarded was 30.7, and only nine of the total 80 prizewinners surpassed this average. In contrast, it was observed that in many years, there were laureates with just zero, one, two or three nominations − an indicator of high subjectivity, as verified by experts on bibliometric data. From the data presented, it is concluded that Lattes (as well as his colleague, collaborator and friend 'Beppo' Occhialini) received enough nominations to be awarded the Nobel Prize not once but twice; thus, the necessity of a letter on this subject remains valid.

Keywords: Lattes, Bohr, Missing letter, Nobel Prize, Nominees and Nominators, Physics.

1. INTRODUCTION

There is a myth relating a possible missing letter from the Danish theoretical physicist Niels Henrik David Bohr (1885-1962), winner of the 1922 Nobel Prize in Physics, to Cesare Mansueto Giulio Lattes (1924-2005), the most famous Brazilian physicist [1, 2]. Due to his important contributions to the development of particle physics, particularly the co-discovery of the *pi*-meson, the media in Brazil elevated Lattes to the status of a hero, according to Vieira and Videira [3].

In fact, some of Lattes' fame is owed to his participation in experiments that proved the existence of the *pi*-meson (or *pion*) [4,5], a particle theoretically proposed in 1935 by the Japanese physicist Hideki Yukawa (1907-1981), who won the 1949 Nobel Prize in Physics, and that contributed to the birth of elementary particle physics [6]. Lattes' works influenced and motivated the development of experimental physics in Brazil, including his new nuclear emulsion technique compositions [7], the foundation of a national center dedicated to physics research (www.CBPF.br), the formation of the Brazil-Japan Collaboration, the foundation of a physics department at the University of Campinas, and the foundation of the National Research Board ("Conselho Nacional de Pesquisas" in *Portuguese*), now known as the National Board for Science and Technology Development ("Conselho Nacional de Desenvolvimento Científico e Tecnológico", or www.CNPq.br), among others, *i.e.*, the beginning of Brazilian "Big Science" [3].

Two seminal papers were co-authored by Lattes [4, 5]; the first paper showed the detection of *pi*-meson cosmic radiation particles using his new emulsion technique, with which a veritable web of tracks never before observed in any experiment were found. The second showed the production of artificial mesons at the synchrocyclotron at Berkeley one year later. Once, regarding the possibility of receiving not one but two Nobel Prizes from these discoveries, Lattes said ironically: "Occhialini and I come unstuck" (about the first discovery) [8]. Additionally, for Lattes, the second possibility diminished because his colleague Eugene Gardner died in 1950 at the age of 37 from berylliosis [3, 8]. Thus, it was another opportunity he assumed "was carried by history" [3]. It is also important to note that Giuseppe "Beppo" Occhialini's contributions to science are related to Lattes' first work relating the *pi*-meson, as well as the discovery of the positron in cosmic rays at the Cavendish Laboratory of Cambridge, in

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collaboration with Patrick Maynard Stuart Blackett (1897-1974, 1948 Nobel Prize in Physics), using cloud chambers. Thus, there were two nomination possibilities for Beppo, as well as for Lattes, as described below.

In such a missing letter, there would be explanations or reasons for why Lattes did not receive the Nobel Prize in Physics, which was won by his British colleague Cecil Frank Powel (1903-1969) "for his development of the photographic method of studying nuclear processes and his discoveries regarding mesons made with this method," according to the Nobel Prize committee. As far as the author knows, there is only one claim that Niels Bohr wrote a letter explaining why Lattes wasn't awarded the Nobel Prize, according to Cabral [1]. He wrote once in an important book: "Powell received the Nobel Prize of 1950 for the discovery, an award that Latin Americans feel should have gone to Lattes. A letter from Niels Bohr, to be opened in 2012, supposedly explains Lattes's exclusion."

Some evidences could indirectly reinforce the letter myth, *e.g.*, the fact that Lattes' first discovery of cosmic ray particles in early 1947 [4] was followed by a subsequent meeting between Lattes and Bohr in late 1947 [3]. One evening after a lecture, Lattes was invited to the Carlsberg Mansion, a stately home the well-known Danish brewery had loaned to Bohr (he was also a national hero). There, the Brazilian revealed to Bohr that he wanted to go to the United States because he was sure he would be able to detect the *pi*-meson in what was the most powerful particle accelerator in the world at that time, *i.e.*, the 184-inch synchrocyclotron at the University of California's Radiation Laboratory in Berkeley.

A second fact reinforcing the letter myth is that his new discovery, *i.e.*, the detection of the artificial *pi*-meson, was described as the most important event in physics in 1948, according to the science section of *The New York Times* [9]. In Brazil, Lattes received an honorary doctorate from the University of São Paulo in 1948 [3] after graduating in 1943 from the same university. He had the opportunity to study with the great scientists in Brazil at that time, such as G. Occhialini, M. Schenberg, M. Damy and G. V. Wataghin, among others.

2. THE BOHR ARCHIVE ON LATTES

Part of the mystery is now solved; there is no letter, at least at the Niels Bohr Archive (www.nba.nbi.dk). Something was found named Lattes in series 1, box 16 / La-Le, folder 25 that was dated 1949; however, it was just a *clipping* from the Brazilian journal "Folha da Manhã" ("*Morning Press*"), São Paulo, dated April 8, 1949 on page 19 and signed by J. de Monte Claro (Figure 1). In fact, this newspaper clipping, collected by the Danish Foreign Ministry, is the only item at the Niels Bohr Archive under the name Lattes and is dated April 13, 1949.

According to Figure 1, the written content (in Danish) was as follows: "Interview med den brasilianske atomforsker, professor Cesar Lattes, der I slutningen bemaerker: 'Som eksempel og opmuntring (til støtte af atomforskningen) vil jeg minde om den gavmilde støtte der ydes af Danmark, hvor Niels Bohr, der er indehaver af Nobel-prisen for fysik og en af de storste nulevende fysikere, nu har indrettet sit institut for atom-fysik i København med stotte af et bryggeri."'

The following is a simple translation: "Interview with the Brazilian atomic researcher, professor Cesar Lattes, who at the end remarks: 'As an example and encouragement (in support of atomic research) I will remind you of the generous support that is granted by Denmark, where Niels Bohr, who is a holder of the Nobel Prize for Physics and one of the greatest physicists alive, has now organized his institute for atomic physics in Copenhagen with support from a brewery"'.

The title of the news in Figure 1 is "Unlimited potential of nuclear energy on the peaceful application of its availabilities. Talk to *Folhas* the Professor Cesar Lattes - Cosmic Rays Course at the Faculty of Philosophy" ("Ilimitado o potencial da energia nuclear quanto à aplicação pacífica das suas disponibilidades. Fala às *Folhas* o professor Cesar Lattes - Curso de Raios Cósmicos na Faculdade de Filosofia"). A picture shows the young Cesar Lattes and his wife, Martha Siqueira Neto Lattes (1923-2003), having just married at that time.

3. THE NOBEL PRIZE IN PHYSICS NOMINATIONS AND NOMINEES FROM 1901 TO 1963

To shed light on Lattes' possible missing letter and why he was not awarded the Nobel Prize, let us consider a new perspective using the official Nobel website public data from the first prize in 1901 to 1963. There is a rule stating that the names of nominees and other information about the nominations cannot be revealed for a period of 50 years. The Nobel Prize in Physics nomination process is briefly explained on the home page (www.nobelprize.org), indicating that nominations were "by invitation only," where "confidential forms are sent to persons who are competent and qualified to nominate. One nominator can choose more than one indication per year." According to the rules, "the candidates eligible for the Physics Prize are those nominated by qualified persons who have received an invitation from the Nobel Committee to submit names for consideration. No one can nominate himself or herself," and the prize can be shared by up to three people. The names of the nominees and other information about the nominations are allowed into the public domain after 50 years, but it is still difficult to find studies and analyses in large-scale from such lists [10-15]. Rablen and Oswald [10] observed that, for the first 50 years of the Nobel Prize (NP): *i*) winners were first nominated for a NP some ten years earlier on average than were nominees; *ii*) the Physics Prize had tended to draw from a smaller pool of scientists, those being first nominated at a younger age (48.5 ± 12.0 years is the mean age at first nomination) and also winning earlier (48.8 ± 10.4 years is the mean age of winning); *iii*) the mean number of years nominated in Physics is 4.1 ± 3.9 years; and *iv*) regarding nationality, 24.8% of the winners were from the *U.S.* and 70.2% from Europe, with Germany as the most represented country.

Gingras and Wallace [11] presented a bibliometric study based on citation data from the profile of NP winners in Physics from 1901 to 2007. These studies have substantial

predictive power *a posteriori*, but most of the studies are not able to predict a prizewinner. However, some of the studies can identify a group of candidates likely to win the NP [11]. Ashton and Oppenheim [14] generalized the citation statistics studies, including non-first authors' analyses for the NP in Chemistry.

It is also important to cite that Eugene Garfield [12] was one of the first to explore bibliometric studies in an attempt to elucidate the profile of prizewinners by describing winners or simply nominated, the latter being a subset of "Nobel class" scientists. According to him, and not surprisingly, it was found that this set of scientists did not differ in citation frequency from the "average" scientist [13] until an NP was awarded.

We investigated quite a few considerations, mainly relating to the Brazilian scientist, using nominations and nominees placed in the public domain by the Nobel Foundation. For example, it is possible to know that Bohr and Yukawa never nominated Lattes and that Lattes did not nominate anyone in the period analyzed. In fact, on the Nobel Prize website, it is possible to access all of Lattes' nominations (search of the Nomination Database). Table 1 shows the nominators, countries, nominees and years, in agreement with Vieira and Videira's [3] research. Thus, Lattes was nominated in 1949 by Walter S. Hill Rodriguez of Uruguay, who also nominated Eugene Gardner that year and Charles H. Townes in 1963. He was nominated by James Holley Bartlett, Jr. of the *U.S.*, who also nominated "Beppo" Occhialini (1907-1993) and Powell that year. Wataghin nominated Lattes in 1951. There is no record of either Hill Rodriguez, Bartlett or Wataghin submitting other indications in the Nominations Database. Lattes was nominated in 1952, 1953 and 1954 by Leopold Ruzicka from Zurich, winner of the 1939 Nobel Prize in Chemistry. In 1952, he was also nominated, together with Wolfgang K. H. Panofsky (Stanford), by Marcel Schein in Chicago – Schein also nominated Yukawa in 1948 and George D. Rochester and C. Butler in 1957. All such physicists (Hill Rodriguez, Bartlett, Wataghin and Schein) had contact with Lattes during his career to some degree, but it is still a surprise that Ruzicka nominated him three times.

The same database shows that Occhialini was nominated 27 times from 1936 to 1963, including ten times by Patrick M. S. Blackett and three times by Cecil F. Powell. Interestingly, Powell was nominated 23 times between 1949 and 1951; one year later, Powell received his last nomination, after which he was awarded the NP. It is important to note that of Lattes' other co-authors in such seminal works [4, 5], Muirhead received no indications and Gardner only one (as shown in Table 1).

Additionally, other data considering the Physics Nomination Database is presented in Table 2. From such research, it was possible to note that some laureates still received nominations after receiving the NP, such as Albert Einstein and Max Planck with 62 and 74 nominations in all, respectively. However, in this work, we did not consider nominations after receiving the NP because it could be observed as a simple delay or even an interest of the nominator for a second prize. The only person to receive the NP in Physics twice was John Bardeen in 1956 (8 nominations between 1952-1956) and in 1972 (4 more nominations between 1961-1963). Gingras and Wallace [11] observed that NP Physics laureates were awarded prizes within a year of their discovery (a condition very close to Lattes' works) only four times between 1901 and 2004. From this table, it is possible to note that there was a minimum of 16 total nominations (in 1923, won by R. Millikan) and a maximum of 80 total nominations (in 1960, won by D. Glaser). The lowest number of nominations for a prizewinner was zero in the period analyzed and occurred twice: in 1957 (T.-D. Lee and C. N. Yang) and 1958 (P. Cherenkov and I. Frank – I. Tamm received three nominations). It is also important to note that the 1957 Nobel Prize had a high number of total nominations, *i.e.*, 65, and 50 total nominations one year later. Figure 2*a* presents the number of nominations in this period.

The highest number of nominations (considering data up to the year of Nobel Prize) was received by Otto Stern (1888-1969), with a total of 82 nominations. Figure 2*b* also shows that in many years, there were laureates with just one, two or three nominations. In fact, 31 of the 80 total laureates from 1901 to 1963 received up to 10 nominations and were certainly all great scientists. There was a total of 2,457 nominations in Physics for this time period, resulting in an average of 30.7 nominations for each winner – but only nine of the laureates surpassed this average, as indicated in Figure 2*b*. Additionally, we did not consider nominators that insisted on some nominees other than Blackett (there are many cases to cite) in our analysis. As only very few nominees received so many nominations, it is thus necessary to admit a high level of subjectivity for the Nobel Prize selection in Physics based on the data in Table 2 and Figure 2. These results are in agreement with the subjectivity level that seems to occur in the Nobel Prize selection process, as noted by Garfield [15].

There are two important points to clarify. Regarding youth, it is almost certain that age was not a problem for Lattes to receive a NP because William Lawrence Bragg (1890-1971) was the youngest Physics Laureate ever (age 25). At that time, W. L. Bragg was awarded the 1915 Physics Prize together with his father (recently, the Academy awarded the 2014 Nobel Peace Prize to Malala Yousafzai, age 17). Rablen and Oswald [10] noted that NP Physics winners are younger when first nominated, usually in their 30's. The other situation could be related to location / birthplace: it is important to note that the first Nobel Prize in Physics outside Europe or America was awarded to Raman in 1930. The results in Table 2 agree with Rablen and Oswald's [10] analysis between 1901 and 1950 related to the predominance of European countries (approximately 70% of awarded scientists), especially Germany. Table 2 also shows that the number of nominations for each candidate was not a problem for Lattes because many laureates received fewer nominations, *e.g.*, Lawrence Bragg and von Laue (just two nominations each) or Nils Gustaf Dalén, Gustav Hertz and Charles Glover Barkla (only one nomination each). Figure 2*b* shows an interesting depiction of this particular analysis.

According to Vieira and Videira [3], the much sought-after Nobel Prize – even if sought for him more by others than by Lattes himself [2] – was never forthcoming. Nonetheless, it is worth remembering here that Gardner and Lattes' work was conducted at a time when the discovery of a new particle earned its discoverers a Nobel Prize.

Other great and famous physicists, such as Arthur Schuster (1851-1934), Henri Poincaré (1854-1912), Friedrich Paschen (1865-1947), Arnold Sommerfeld (1868-1951) and Paul Langevin (1872-1946), had already been nominated on several occasions. According to Gingras and Wallace [11], the predictive power of Nobel Prizes from bibliometric measures has decreased over time and has now become greatly limited in the XXI century mainly due to the fragmentation of knowledge and implicit hierarchy, particularly in Physics. Undoubtedly, Lattes is the most well-known Brazilian physicist. The deserved Nobel Prize was announced posthumously in the form of a typo; one day after his death, the Associated Press (AP) published the following note: "Cesar Lattes, a Nobel prize-winning physicist known for his work with subatomic parties has died" [16].

4. CONCLUSIONS

In this work, data on Nobel Prize winners, nominations and nominees in Physics between 1901 and 1963 were used. It was found that there was an average number of 30.7 nominations per Nobel Prize awarded, and only nine of the 80 total prizewinners surpassed this average. Experts in bibliometric measuring affirmed that there is a level of subjectivity regarding Nobel Prize nominations, in addition to some power of prediction, which is presently decreasing. According to the data presented, we verified that Lattes, as well as Beppo Occhialini, received enough nominations to be awarded an NP during their lifetimes. Unfortunately, the history of physics includes many great scientists who were only nominated. However, Lattes and Occhialini, in particular, had works and recognitions worthy of receiving not only one but two prizes *each*. It is clear that Lattes' first work was performed by a team, involving mainly Occhialini and Powell in co-authorship; however, in his second work with Gardner, he was the proponent, *i.e.*, the main author. We can also conclude that there is no longer controversy regarding Bohr and Lattes, at least according to the Bohr Archives, but from the evidences exposed, the possibility of a missing letter still remains...

ACKNOWLEDGEMENTS

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Kgl. Dansk Gesandtskab
Rio de Janeiro
J. Nr. 110.A.3.
den 13. april 1949.
Udklip af: Folha da Manhã, São Paulo
Dato: den 8.4.1949.
Presse Nr. 32
Indhold:
Atomforskning
Interview med den brasilianske atomforsker, professor Cesar Lattes, der i slutningen bemærker: "Som eksempel og opmuntring (til støtte af atomforskningen) vil
Cesar Lattes
"Ilimitado o potencial da energia nuclear quanto à aplicação pacifica das suas disponibilidades"
Fala às Folhas o prof. Cesar Lattes — Curso de raios cosmicos na Faculdade de Filosofia
Niels Bohr Archive, Copenhagen

Figure 1. The first of a two-page clipping about Cesar Lattes at the Niels Bohr Archive, Copenhagen.

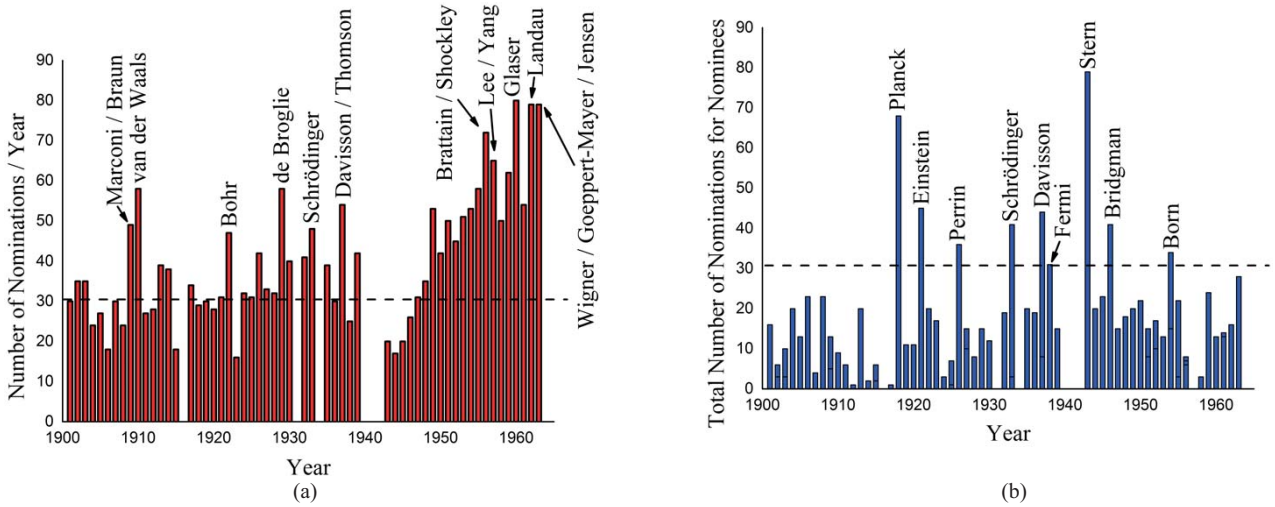

Figure 2. The number of nominations at that year (a) and the total number of nominations for nominees up to that year (b) from 1901 to 1963, according to the Nobel Prize Nominators Database. A horizontal dashed line indicates the average number of 30.7 nominations per No*b*el Prize awarded. Only nine from a total of 80 prizewinners surpassed this average and are indicated (according Figure 2b). No Nobel Prizes were awarded in 1916, 1931, 1934, 1940-1942.

Nominator	**Country**	**Nominee**	**Year**
Walter Scott Hill Rodriguez	Uruguay	Cesare Mansueto Giulio Lattes, Eugene Gardner	Physics 1949
James Holley Bartlett	USA	Cesare Mansueto Giulio Lattes, Giuseppe Paolo Stanislao Occhialini**, Cecil Powell	Physics 1949
Gleb Vassielievich Wataghin	Italy	Cesare Mansueto Giulio Lattes	Physics 1951
Leopold Stephen Ruzicka*	Switzerland	Cesare Mansueto Giulio Lattes	Physics 1952
Marcel Schein	USA	Cesare Mansueto Giulio Lattes, Wolfgang Kurt Hermann Panofsky	Physics 1952
Leopold Stephen Ruzicka	Switzerland	Cesare Mansueto Giulio Lattes	Physics 1953
Leopold Stephen Ruzicka	Switzerland	Cesare Mansueto Giulio Lattes	Physics 1954

Table 1. All five of Lattes' nominators from 1949 to 1954, according to the Nobel Prize Nominators Database. W. S. Hill Rodriguez (1903-1987) was a professor of physics at Universidad de la Republica, Montevideo, Uruguay. J. H. Bartlett (1904-2000) was an emeritus professor in the Department of Physics at the University of Illinois during 1930 – 1965. From 1928 to 1930, he studied at the University of Leipzig, Swiss Federal Institute of Technology, Zurich, the University of Bristol, and Cambridge University. G. V. Wataghin (1899-1986) was a Ukrainian-Italian theoretical and experimental physicist that introduced Lattes to physics as his professor at the University of São Paulo, Brazil [3]. M. Schein (1902-1960) was a Slovakian-born American physicist, working on cosmic rays, who was a colleague of Lattes. Lattes was also a visiting professor at the University of Chicago from 1955-1958 [3]. Schein donated a Wilson Chamber to Lattes for installation at Chacaltaya Laboratory [2]. (*) Lavoslav Stjepan Ružižka (1887-1976) was born in Croatia and was the winner of the 1939 Nobel Prize in Chemistry. He worked for most of his life in Switzerland. (**) According to Marques, Occhialini's middle names were fictitious [2] but in a recent paper, he assumed to be in doubt [17].

Year	Winner	Country	Number of Nominations that Year	Total Number of Nominations for Nominees	Period
1901	Wilhelm C Rntgen	Germany	30	16	1901-1901
1902	Hendrik Antoon Lorentz	Netherlands	25	6	1902-1902
1902	Pieter Zeeman	Netherlands	35	3	1901-1902
1903	Pierre Curie	France	35	8	1902-1903
1903	Antoine Henri Becquerel	France	35	10	1901-1903
1903	Marie Curie, ne Sklodowska	Poland / France	35	3	1902-1903
1904	Lord Rayleigh	United Kingdom	24	20	1902-1904
1905	Philipp Eduard Anton von Lenard	Austria-Hungary / Germany	27	13	1901-1905
1906	Joseph John Thomson	United Kingdom	18	23	1902-1906
1907	Albert Abraham Michelson	United States	30	4	1904-1907
1908	Gabriel Lippmann	France	24	23	1901-1908
1909	Guglielmo Marconi	Italy	49	13	1901-1909
1909	Karl Ferdinand Braun	Germany	49	5	1905-1909
1910	Johannes Diderik van der Waals	Netherlands	58	9	1901-1910
1911	Wilhelm Wien	Germany	27	6	1907-1911
1912	Nils Gustaf Daln	Sweden	28	1	1912-1912
1913	Heike Kamerlingh-Onnes	Netherlands	39	20*	1909-1913
1914	Max von Laue	Germany	38	2	1914-1914
1915	William Henry Bragg	United States	18	6	1914-1915
1915	William Lawrence Bragg	Australia / United States	18	2	1915-1915
1917	Charles Glover Barkla	United Kingdom	34	1♢	1918-1918
1918	Max Planck	Germany	29	68	1907-1918
1919	Johannes Stark	Germany	30	11	1914-1919
1920	Charles douard Guillaume	Switzerland	28	11	1902-1920
1921	Albert Einstein	Germany / Switzerland	31	45	1910-1921
1922	Niels Bohr	Denmark	47	20♣	1917-1922
1923	Robert Andrews Millikan	United States	16	17	1916-1923
1924	Manne Siegbahn	Sweden	32	3♡	1925-1925
1925	James Franck	Germany	31	7	1923-1925
1925	Gustav Hertz	Germany	31	1	1924-1925
1926	Jean Baptiste Perrin	France	42	36♠	1913-1926
1927	Arthur Holly Compton	United States	33	15	1925-1927
1927	Charles Thomson Rees Wilson	United Kingdom	33	10	1915-1927
1928	Owen Willans Richardson	United Kingdom	32	8	1924-1928
1929	Prince Louis-Victor Pierre Raymond de Broglie	France	58	15	1925-1929
1930	Chandrasekhara Venkata Raman	India	40	12	1929-1930
1932	Werner Heisenberg	Germany	41	19	1928-1932
1933	Erwin Schrdinger	Austria	48	41	1928-1933
1933	Paul Dirac	United Kingdom	48	3	1929-1933
1935	James Chadwick	United Kingdom	39	20	1934-1935
1936	Victor Francis Hess	Austria	30	4	1931-1936
1936	Carl David Anderson	United States	30	19	1934-1936
1937	Clinton Joseph Davisson	United States	54	44	1929-1937
1937	George Paget Thomson	United Kingdom	54	8	1931-1937
1938	Enrico Fermi	Italy	25	31·	1935-1938
1939	Ernest Lawrence	United States	42	15	1938-1939
1943	Otto Stern	United States	20	79	1925-1943
1944	Isidor Isaac Rabi	United States	17	20	1939-1944
1945	Wolfgang Pauli	Austria	20	23	1933-1945
1946	Percy Williams Bridgman	United States	26	41⊗	1919-1946
1947	Edward Victor Appleton	United Kingdom	31	15	1935-1947
1948	Patrick Maynard Stuart Blackett	United Kingdom	35	18	1936-1948
1949	Hideki Yukawa	Japan	53	20	1940-1949
1950	Cecil Frank Powell	United Kingdom	42	22	1949-1950
1951	John Douglas Cockcroft	United Kingdom	50	15	1937-1951
1951	Ernest Thomas Sinton Walton	Ireland	50	8	1937-1951
1952	Felix Bloch	Switzerland / United States	45	17	1948-1952
1952	Edward Mills Purcell	United States	45	10	1949-1952
1953	Frits Zernike	Netherlands	51	13	1944-1952
1954	Max Born	Germany / United Kingdom	53	34	1930-1954
1954	Walther Bothe	Germany	53	15	1934-1954
1955	Willis Eugene Lamb	United States	58	22	1951-1955
1955	Polykarp Kusch	United States	58	3	1952-1955

cont.

1956	John Bardeen	United States	72	8	1953-1956
1956	Walter Houser Brattain	United States	72	7	1953-1956
1956	William Bradford Shockley	United States	72	6	1954-1956
1957	Tsung-Dao Lee	China / United States	65	0	
1957	Chen Ning Yang	China / United States	65	0	
1958	Pavel Alekseyevich Cherenkov	Soviet Union	50	0	
1958	Ilya Frank	Soviet Union	50	0	
1958	Igor Yevgenyevich Tamm	Soviet Union	50	3	1957-1958
1959	Owen Chamberlain	United States	62	8	1957-1959
1959	Emilio Gino Segr	Italy / United States	62	$24^{\oplus}$	1953-1959
1960	Donald Arthur Glaser	United States	80	13	1959-1960
1961	Robert Hofstadter	United States	54	14	1958-1961
1961	Rudolf Ludwig Mssbauer	Germany	54	13	1961-1961
1962	Lev Davidovich Landau	Soviet Union	79	16	1954-1962
1963	Eugene Paul Wigner	Hungary / United States	79	24	1953-1963
1963	Maria Goeppert-Mayer	United States	79	$26^{\emptyset}$	1955-1963
1963	Johannes Hans Daniel Jensen	Germany	79	$28^{\diamondsuit}$	1955-1963

Table 2. All Nobel Prize in Physics nominations, from 1901 to 1963 and the respective total number of nominations for nominees in a determined period (up to the Nobel Prize year), according to Nobel Prize Nominators Database.
(*) Onnes received 3 other nominations for Chemistry between 1910 and 1911; ($\diamondsuit$) Barkla received just one nomination one year after Prize, done by Rutherford; ($\clubsuit$) Bohr received 2 nominations for Chemistry, one in 1920 and other in 1929; ($\heartsuit$) Siegbahn received his three nominations one year after Prize; ($\spadesuit$) Perrin received 11 other nominations for Chemistry between 1915 and 1926; ($\dot{}$) Fermi received 3 other nominations for Chemistry between 1935 and 1937; ($\otimes$) Bridgman received 1 more nomination for Chemistry in 1930; ($\oplus$) Segre received 7 nominations for Chemistry between 1954-1958; ($\emptyset$) Goeppert-Mayer received 1 more nomination for Chemistry in 1958; ($\diamondsuit$) Jensen received 1 more nomination for Chemistry in 1958.

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