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Short biography of Hans G.A. Hellmann (1903-1938)

Hans Gustav Adolf Hellmann, one of the pioneers of quantum chemistry, was born in Wilhelmshaven, a harbor town of northwestern Germany, on the 14th of October, 1903. He studied physics in the post world war I period, from 1922-1929, for most of the time in Stuttgart. Among his teachers were Kossel and Ewald. As a student in Kiel he performed an experimental study of complex dielectric coefficients of ionic solutions, thereby verifying a prediction of the Debye-Hückel-Onsager-Falkenhagen theory. His master thesis on radioactive materials was supervised in Berlin by Otto Hahn and Lise Meitner. At the age of 25 he graduated as a Dr.-Ing. with an experimental investigation of the decay of ozone. In the home of his Ph.D. advisor, Prof. Regener, lived at that time an attractive orphan of Jewish-Ukrainian origin, Victoria Bernstein. Hans Hellmann courted and married her, and just on Hans Hellmann's birthday, Oct. 14, 1929, their son, Hans Hellmann jr. was born.

In the same year, 1929, Hans Hellmann obtained a postdoctoral fellowship at the Hannover Institute of Technology. With the professors Biltz, Klemm and Fischer, chemistry was strongly represented there, and the world center of quantum physics of the time, Göttingen, was only 100 km to the south. Hellmann's interest turned to the quantum mechanical interpretation of chemical bonding and molecular structure. Initially he refuted - on the basis of the Dirac equation - the speculation that the spin is only an apparent property of bound electrons. Then he developed, already in 1933, the "diatomics in molecules" approach, and solved several open questions, for instance concerning the geometric structure of HN_3. In the same year he published, in an important paper (Z. Physik 1933, *85*:180), the molecular virial theorem (a little earlier than Slater) and the force theorem, which later became known as the Hellmann-Feynman theorem. He applied these concepts to the elucidation of the physical nature of the chemical bond, thereby anticipating some of the ideas later promulgated by Ruedenberg. Together with the young physical chemist W. Jost, Hellmann tried (Z. Elektrochemie 1934, 40:806) to communicate the basic ideas of quantum chemistry (a phrase coined by the Austrian physicist A. Haas in 1929) and of chemical bonding to the general chemistry community. His application to "habilitate" with the scientific contributions above was refused and he was fired from his post as an assistant professor on Dec. 24, 1933; he had become undesired, because his wife was Jewish.

Due to the origin of his wife and his political inclination, he had already tried before to gain a scientific position in the Soviet Union. Now he was offered and took the opportunity to move into a leading position at the Karpov State Institute of Physical Chemistry in Moscow. There he finished in 1934 the first paper on the pseudopotential approach (under the title of the "Kombiniertes Näherungsverfahren"), one year before Gombás or 15 years before Phillips and Kleinman. He developed and applied the pseudopotential approach to molecules and solids and published his results in Russian journals, dominantly in German. Two short communications also appeared in English (J. Chem. Phys. 1935, 3:61 and 1936, 4:324). He also worked on other topics such as electrostatic and dispersion interactions, and on elementary diabatic and adiabatic reactions. He continued writing articles for the "ordinary chemist" and even for the scientifically interested laymen, in the Russian language. And he completed the manuscript on the first text-book of Quantum Chemistry, which he had already begun in Hannover. Early 1937 the "Kvantovaja Khimija" came out in Moscow, two years after Pauling and Wilson's "Introduction to Quantum Mechanics" and Van Vleck and Sherman's review of"Quantum Theory of Valence", and three years before Pauling's "Nature of the Chemical Bond". A revised and more compact edition of Hellmann's book in German "Einführung in die Quantenchemie" was finally published at the end of 1937 in pre-Nazi

Vienna. During the "Great Terror" of 1937/38 in the Soviet Union (S. Courtois et al.: The black book of communism, Harvard 1999) Hans Hellmann was liquidated at the age of 34 on May 29, 1938. His son, Dipl.-Ing. Hans Hellmann, was permitted to leave Russia not earlier than 1991 and lives now in Siegen, Germany.

An extended bio- and bibliography of Hellmann in German has appeared in Bunsen-Magazin 1999 (ISSN 0005-9021) 1:10-21 and 2:60-70). Reprints may be ordered from schwarz@chemie.uni-siegen.de. An English translation is also available.

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List of publications of Hans Hellmann

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This list contains all publications of Hans Hellmann (* 14 Oct 1903, + 29 May 1938), German physicist and pioneer of quantum chemistry, as far as they are currently known [1-3]. Also included are a few publications of his colleagues and co-workers, where the fact that Hellmann was a co-author was not or could no longer be mentioned in the German Reich or in the Soviet Union, for political reasons.

The publications are arranged (mainly) in chronological order, usually according to the date of receipt of the manuscripts by the journals' editorial office. Each entry gives the authors' names and the title of the publication in the original language (German, Russian, or English). The place of origin and the date of receipt of the manuscript are also indicated. This information is then augmented by an English version of the title for work published in German or in Russian. If available, the English titles were taken from standard reference sources [4] (sometimes after slight modification). The bibliographic information for articles is completed by journal title, journal volume, year of publication, and page range, with abbreviations for journal titles as obtained from the Chemical Abstracts Service Source Index (CASSI) Search Tool. Finally, information on entries in standard reference sources [4] is given. An annotation with background information is added in some cases.

Please note: Links to electronic versions of articles are active, but links to PDF versions are not.

- **Kiel and Stuttgart (1925-1929)**

    1. H. Hellmann, H. Zahn (Kiel - 14 Sep 1925).
    Eine neue Methode zur Bestimmung der Dielektrizitätskonstante gutleitender Elektrolytlösungen.
    [A new method for the determination of dielectric constants of well-conducting electrolytic solutions (in German)]
    Phys. Z. **26** (1925) 680-682
    [C. A. **20**:1024, CAN 20:8376 / Sci. Abstr. A **29** (1926) 373 / C. 1926 I, 982].
    Paper read by H. Zahn at the "III. Deutscher Physikertag", Danzig, September 1925.

    2. H. Hellmann, H. Zahn (Kiel - 11 Apr 1926).
    Die Dielektrizitätskonstanten gut leitender Elektrolytlösungen.
    [The dielectric constant of solutions of electrolytes of high conductivity (in German)]

Ann. Phys. (Leipzig) [4. Folge] **80** (1926) 191-214 (DOI: 10.1002/andp.19263851006)
[C. A. **20**:3262, CAN 20:26243 / Sci. Abstr. A **29** (1926) 2440 / C. 1926 II, 869].

3. H. Hellmann, H. Zahn (Kiel / Stuttgart - 12 Aug 1926).
Über die Dielektrizitätskonstante verdünnter wäßriger Elektrolytlösungen.
[The dielectric constant of dilute aqueous solutions of electrolytes (in German)]
Phys. Z. **27** (1926) 636-640
[C. A. **21**:1748, CAN 21:14266 / Sci. Abstr. A **30** (1927) 783 / C. 1926 II, 3023].

4. H. Hellmann, H. Zahn (Kiel / Stuttgart - 28 Aug 1926).
Die Dielektrizitätskonstanten gutleitender Elektrolytlösungen (Zweiter Teil).
[The dielectric constants of electrolyte solutions of good conductivity (second part, in German)]
Ann. Phys. (Leipzig) [4. Folge] **81** (1926) 711-756 (DOI: 10.1002/andp.19263862305)
[C. A. **21**:696, CAN 21:5663 / Sci. Abstr. A **30** (1927) 1872 / C. 1927 I, 570].

5. H. Hellmann, H. Zahn (Kiel / Stuttgart - 14 Dec 1927).
Über Dielektrizitätskonstanten von Elektrolytlösungen. Erwiderung auf den gleichnamigen Artikel von P. Walden, H. Ulich und O. Werner.
[Dielectric constants of solutions of electrolytes. Reply to an article of same title by P. Walden, H. Ulich and O. Werner (in German)]
Z. Phys. Chem. Stöchiom. Verwandtschaftsl. **132** (1928) 399-400
[C. A. **22**:4347, CAN 22:36617 / C. 1928 I, 2582].

6. H. Hellmann, H. Zahn (Kiel / Stuttgart - 21 May 1928).
Über Dielektrizitätskonstanten von Elektrolytlösungen (Erwiderung auf den gleichnamigen Artikel von P. Walden, H. Ulich und O. Werner).
[Dielectric constants of electrolytic solutions. Reply to an article of same title by P. Walden, H. Ulich and O. Werner (in German)]
Ann. Phys. (Leipzig) [4. Folge] **86** (1928) 687-716 (DOI: 10.1002/andp.19283911303)
[C. A. **22**:4348, CAN 22:36618 / Sci. Abstr. A **31** (1928) 3106 / C. 1928 II, 1532].

7. H. Hellmann, H. Zahn (Kiel - 01 Oct 1928).
Nachtrag zu unserer Arbeit: Über Dielektrizitätskonstanten von Elektrolytlösungen.
[Supplement to our paper: "The dielectric constants of electrolytic solutions" (in German)]
Ann. Phys. (Leipzig) [4. Folge] **87** (1928) 716 (DOI: 10.1002/andp.19283922106)
[C. A. **23**:558, CAN 23:4428].

8. H. Hellmann (Stuttgart - 03 Apr 1929).
Analyse von Absorptionskurven für allseitige Inzidenz inhomogener Strahlung bei ebenen Grenzflächen.
[Analysis of absorption curves for incidence from all directions of inhomogeneous radiation at planar interfaces (in German)]
Phys. Z. **30** (1929) 357-360
[Sci. Abstr. A **32** (1929) 3536 / C. 1929 II, 831].

9. H. Hellmann (Stuttgart - 07 Jul 1929).
Über das Auftreten von Ionen beim Zerfall von Ozon und die Ionisation der Stratosphäre.
[The appearance of ions on the decomposition of ozone, and the ionization of the stratosphere (in German)]

Ann. Phys. (Leipzig) [5. Folge] **2** (1929) 707-732 (DOI: 10.1002/andp.19293940607)
[C. A. **24**:23, CAN 24:239 / Sci. Abstr. A **33** (1930) 740 / C. 1929 II, 2418].
This article is related to Hellmann's dissertation (Dr.-Ing., Physikalisches Institut der Technischen Hochschule Stuttgart [doctorate in engineering from the Physical Institute of the Stuttgart Institute of Technology]), submitted on 06 Apr 1929. Referees were Prof. Dr. Erich Regener (1881-1955) and Prof. Dr. Richard Glocker (1890-1978). Regener let his students publish their dissertation works under their sole authorships. Offprints of this article were published as dissertation by the publishing house J. A. Barth, Leipzig (II + 26 p. and CV, date of publication: 29 May 1929). A longer version of the dissertation, which existed originally, is no longer available at the university library at Stuttgart.

- **Hannover (1930-1934)**

10. E. Fues, H. Hellmann (Hannover, TH - 22 Mar 1930).
Über polarisierte Elektronenwellen.
[Polarized electron waves (in German)]
Phys. Z. **31** (1930) 465-478
[C. A. **24**:4212, CAN 24:38986 / Sci. Abstr. A **33** (1930) 3548 / C. 1930 II, 868].

11. H. Hellmann (Hannover, TH - 24 Mar 1931).
Über die Kristallinterferenzen des Spinelektrons.
[Crystal interference of spin electrons (in German)]
Z. Phys. **69** (1931) 495-506 (DOI: 10.1007/BF01403566)
[C. A. **25**:5616, CAN 25:49878 / Sci. Abstr. A **34** (1931) 3206 / C. 1931 II, 2275].

12. H. Hellmann (Hannover, TH - 22 Jun 1931).
Nachtrag zu meiner Arbeit „Über die Kristallinterferenzen des Spinelektrons".
[Supplement to my paper: "Crystal interference of spin electrons" (in German)]
Z. Phys. **70** (1931) 695-698 (DOI: 10.1007/BF01340757)
[C. A. **25**:5616, CAN 25:49878 / Sci. Abstr. A **34** (1931) 3929 / C. 1932 I, 344].

13. H. Hellmann (Hannover, TiHo - 01 Mar 1933).
Zur Quantenmechanik der chemischen Valenz.
[Quantum mechanics of chemical valence (in German)]
Z. Phys. **82** (1933) 192-223 (DOI: 10.1007/BF01341488)
[C. A. **27**:4999, CAN 27:55806 / C. 1934 I, 3].
Related reference (conference abstract):
H. Hellmann (Hannover, TiHo - 05 Feb 1933).
Zur Quantentheorie der Atombindung.
[On the quantum theory of atomic binding (in German)]
Verh. Dtsch. Phys. Ges. [3] **14** (1) (1933) 13-14.

14. H. Hellmann (Hannover, TiHo - 20 Jul 1933).
Zur Rolle der kinetischen Elektronenenergie für die zwischenatomaren Kräfte.
[Importance of kinetic energy of electrons for interatomic forces (in German)]
Z. Phys. **85** (1933) 180-190 (DOI: 10.1007/BF01342053)
[C. A. **28**:2606[7], CAN 28:21967 / C. 1933 II, 3081].
Related reference (title of conference talk):
H. Hellmann (Hannover, TiHo - 15 Jul 1933).

Zur Rolle der kinetischen Elektronenenergie bei der Wechselwirkung zwischen Atomen.
[Importance of kinetic energy of electrons for the interaction between atoms (in German)]
Verh. Dtsch. Phys. Ges. [3] **14** (2) (1933) 27.

15. H. Hellmann (Hannover, TiHo - 24 Jan 1934).
Eine Absolutmethode zur Messung der Dielektrizitätskonstanten von Elektrolytlösungen bei Hochfrequenz.
[An absolute method for measuring dielectric constants of electrolytic solutions with high-frequency currents (in German)]
Ann. Phys. (Leipzig) [5. Folge] **19** (1934) 623-636 (DOI: 10.1002/andp.19344110603)
[C. A. **28**:3631[4], CAN 28:30548 / C. 1934 II, 206].

    Related work (Hellmann's name could not be mentioned as a co-author, because of political reasons):
    M. Röver (Hannover, TiHo - 07 Aug 1934).
    Messung der Dielektrizitätskonstanten wäßriger Elektrolytlösungen bei Hochfrequenz.
    [Measurement of dielectric constants of aqueous electrolyte solutions at high frequency (in German)]
    Ann. Phys. (Leipzig) [5. Folge] **21** (1934) 320-344 (DOI: 10.1002/andp.19344130308)
    [CAN 29:1325CAN 29:132566].

16. H. Hellmann, W. Jost (Hannover, TiHo und TH - 13 Oct 1934).
Zum Verständnis der „chemischen Kräfte" nach der Quantenmechanik.
[A contribution to the comprehension of "chemical forces" in terms of quantum mechanics (in German)]
Z. Elektrochem. Angew. Phys. Chem. **40** (1934) 806-814
[C. A. **29**:993[5], CAN 29:7853 / C. 1935 I, 511].

    Related work (Hellmann's name could not be mentioned as a co-author, because of political reasons):
    W. Jost (Hannover, TH - 01 Aug 1935).
    Zum Verständnis der „chemischen Kräfte" nach der Quantenmechanik. II.
    [Understanding the "chemical forces" according to quantum mechanics. Part II (in German)]
    Z. Elektrochem. Angew. Phys. Chem. **41** (1935) 667-674
    (DOI: 10.1002/bbpc.19350410907)
    [C. A. **29**:7783[7], CAN 29:59507 / C. 1935 II, 3475].
    "As in part I, the presentation is extensively based on the reasoning of Hellmann's papers."

- **Moscow (1934-1937)**

17. Г. Гельман (G. Gel'man) / H. Hellmann (Moscow - 10 Jun 1934).
О комбинированном приближенном расчете проблемы многих электонов / Über ein kombiniertes Störungsverfahren im Vielelektronenproblem.
[Combined perturbation process in the multiple-electron problem (in Russian and in German)]

C. R. (Dokl.) Acad. Sci. URSS N.S. **4** (1934) 442-444 (in Russian), 444-446 (in German)
[C. A. **29**:2067[3], CAN 29:16155 / C. 1937 I, 4332].

18. H. Hellmann (Moscow - 11 Jul 1934).
Über die Natur der chemischen Kräfte.
[The nature of chemical forces (in German)]
Acta Physicochim. U.R.S.S. **1** (1934/1935) 333-353
[C. A. **29**:6133[7], CAN 29:47238 / C. 1935 I, 3242].

19. H. Hellmann (Moscow - 26 Nov 1934).
A New Approximation Method in the Problem of Many Electrons.
J. Chem. Phys. **3** (1935) 61 (http://dx.doi.org/10.1063/1.1749559)
[C. A. **29**:1317[7], CAN 29:10306 / C. 1936 I, 957].

20. H. Hellmann (Moscow - 17 Dec 1934).
Ein kombiniertes Näherungsverfahren zur Energieberechnung im Vielelektronenproblem.
[A combined approximation method for the energy calculation in the many-electron problem (in German)]
Acta Physicochim. U.R.S.S. **1** (1934/1935) 913-940
[C. A. **29**:6497[7], CAN 29:50091 / C. 1935 II, 645].

21. H. Hellmann (Moscow - 05 Apr 1935).
Zur quantenmechanischen Berechnung der Polarisierbarkeit und der Dispersionskräfte.
[Quantum-mechanical calculation of polarizability and of dispersion forces (in German)]
Acta Physicochim. U.R.S.S. **2** (1935) 273-290
[C. A. **29**:5731[6], CAN 29:44186 / C. 1936 I, 9].

22. H. Hellmann, J. K. Syrkin (Moscow - 05 May 1935).
Zur Frage der anormal kleinen sterischen Faktoren in der chemischen Kinetik.
[Abnormally small steric factors in chemical kinetics (in German)]
Acta Physicochim. U.R.S.S. **2** (1935) 433-466
[C. A. **29**:6497[8], CAN 29:50092 / C. 1936 I, 3962].

23. H. Hellmann (Moscow - 01 Jul 1935).
Bemerkung zur Polarisierung von Elektronenwellen durch Streuung.
[Remarks on the polarization of electron waves by scattering (in German)]
Z. Phys. **96** (1935) 247-250 (DOI: 10.1007/BF01341526)
[C. 1935 II, 2626].

24. Г. Г. Гельман, А. А. Жуховицкий (G. G. Gel'man, A. A. Zhukhovitskij; [without place] - [without date]).
Основные вопросы химического взаимодействия в современной квантовой химии.
[The fundamental questions of chemical reactions in present-day quantum chemistry (in Russian)]
Usp. Khim. **4** (1935) 1149-1193
[C. 1936 II, 249].

25. H. Hellmann (Moscow - 03 Dec 1935).
Ein kombiniertes Näherungsverfahren zur Energieberechnung im Vielelektronenproblem. II.
[A combined approximation method for the energy calculation in the many-electron problem. II. (in German)]
Acta Physicochim. U.R.S.S. **4** (1936) 225-244
[C. A. **30**:4081[3], CAN 30:31055 / C 1936 II, 3981].

26. H. Hellmann (Moscow - 03 Feb 1936).
Bemerkungen zu der Arbeit von E. L. Hill „The virial theorem and the theory of fusion".
[Remarks on "the virial theorem and the theory of fusion" by E. L. Hill (in German)]
Phys. Z. Sowjetunion **9** (1936) 522-528
[C. A. **30**:6257[2], CAN 30:47308 / C. 1937 I, 1105].

27. H. Hellmann, W. Kassatotschkin (Moscow - 15 Mar 1936).
Metallic Binding According to the Combined Approximation Procedure.
J. Chem. Phys. **4** (1936) 324-325 (http://dx.doi.org/10.1063/1.1749851)
[C. A. **30**:4060[2], CAN 30:30905 / C. 1936 II, 1308].

28. H. Hellmann, W. Kassatotschkin (Moscow - 16 May 1936).
Die metallische Bindung nach dem kombinierten Näherungsverfahren
[Metallic Binding According to the Combined Approximation Procedure (in German)].
Acta Physicochim. U.R.S.S. **5** (1936) 23-44
[C. 1936 II, 3638].

29. Г. Г. Гельман (G. G. Gel'man; [without place] - 22 Jul 1936).
Применение метода Томаса-Ферми к проблеме химической связи.
[Application of the Thomas-Fermi method to the problem of the chemical bond (in Russian)]
Usp. Khim. **5** (1936) 1373-1404
[C. A. **31**:1667[6], CAN 31:12298 / C. 1937 I, 4599].

30. Г. Гельман (G. Gel'man; [without place] - [without date]).
Природа материи в свете квантовой химии.
[The nature of matter in the light of quantum chemistry (in Russian)]
Front Nauki Tekh. **8** (1936) 6: 34-48, 7: 39-50
[C. 1936 II, 3876].
Original manuscript in German (47 pages).

31. H. Hellmann (Moscow - [Sep/Oct 1936]).
[Contributed discussions to: F. London. The general theory of molecular forces. Trans. Faraday Soc. **33** (1937) 8-26].
Trans. Faraday Soc. **33** (1937) 40-42 (DOI: 10.1039/TF9373300040), 278-279 (DOI: 10.1039/TF9373300277).

32. H. Hellmann (Moscow - [Sep/Oct 1936]).
[Contributed discussion to: Samuel Glasstone. The structure of some molecular complexes in the liquid phase. Trans. Faraday Soc. **33** (1937) 200-206].
Trans. Faraday Soc. **33** (1937) 208-209 (DOI: 10.1039/TF9373300206).

33. Г. Гельман (G. Gel'man; Moscow - 23 Oct 1936).
Квантовая Химия [Quantum Chemistry (in Russian)].

ОНТИ, Москва и Ленинград [ONTI, Moscow and Leningrad] (1937), 546 c. [C. 1937 II, 3284]
Translated from the German manuscript to Russian by J. Golovin, N. Tunitskij, M. Kovner.
Volume 1 of the series *"Physics in Monographs"*, edited by S. I. Vavilov, I. Ye. Tamm and E. V. Shpolskii.
Book review: J. Syrkin, Acta Physicochim. U.R.S.S. **8** (1938) 138-140

34. H. Hellmann (Moscow - Mar 1937).
Einführung in die Quantenchemie [Introduction to Quantum Chemistry (in German)].
Deuticke, Leipzig and Wien (1937), VIII + 350 p. [C. A. **31**:7737[1], CAN 31:55845 / C. 1937 II, 1518].
Book review: J. Syrkin, Acta Physicochim. U.R.S.S. **8** (1938) 138-140
Book review: O. Schmidt, Z. Elektrochem. Angew. Phys. Chem. **44** (1938) 284
(DOI: 10.1002/bbpc.19380440415)
Book review: Clusius, Angew. Chem. **54** (1941) 156
(DOI: 10.1002/ange.19410541109)
Reprint (reproduction vested by Alien Property Custodian): H. Hellmann. Einführung in die Quantenchemie.
J. W. Edwards, Ann Arbor, Michigan (1944), VIII + 350 p. [C. A. **38**:5458[5], CAN 38:36665]

35. Г. Г. Гельман (G. G. Gel'man; [without place] - 23 Jan 1937).
Проблема валентности в современной органической химии.
[Problems of valency in modern organic chemistry (in Russian)]
Prom-st. Org. Khim. **3** (1937) 259-266

36. H. Hellmann, K. Majewski (Moscow - 11 Apr 1937).
Zur Berechnung der Londonschen Dispersionskräfte bei geringen Atomabständen.
[Calculation of the London dispersion forces for small atomic distances (in German)]
Acta Physicochim. U.R.S.S. **6** (1937) 939-953
[C. A. **32**:2825[3], CAN 32:20221 / C. 1938 I, 531].

37. H. Hellmann, M. Mamotenko (Moscow - 29 Apr 1937).
Die Bestimmung von Elektronenaffinitäten und Valenzzuständen mit Hilfe neuer Interpolationsformeln in der Theorie komplexer Spektren.
[The determination of electron affinities and valence states with the help of new interpolation formulas in the theory of complex spectra (in German)]
Acta Physicochim. U.R.S.S. **7** (1937) 127-147
[C. A. **32**:3260[4], CAN 32:23604 / C. 1938 I, 4580].

38. H. Hellmann, S. J. Pschejetzkij (Moscow - 26 Jun 1937).
Zur Quantentheorie der Polarisierbarkeit von Atomen und Ionen im inhomogenen elektrischen Feld.
[Quantum theory of the polarizability of atoms and ions in inhomogeneous electric fields (in German)]
Acta Physicochim. U.R.S.S. **7** (1937) 621-645
[C. A. **32**:4065[7], CAN 32:29475 / C. 1938 I, 3001].

39. М. Мамотенко, Г. Гельман (M. Mamotenko, G. Gel'man; Moscow - 07 Oct 1937).
Вычисление сродства атомов металлов к электрону
[Calculation of the electron affinity of metal atoms (in Russian)].

Zh. Eksp. Teor. Fiz. **8** (1938) 24-30
[C. A. **33**:4864[7], CAN 33:34401 / C. 1939 II, 330].

40. M. Mamotenko, H. Hellmann (Moscow - 11 Oct 1937).
Die Berechnung von Elektronenaffinitäten mit Hilfe neuer Extrapolationsformeln der optischen Terme. II.
[Calculation of electron affinity with the help of a new optical-term extrapolation formula. II. (in German)]
Acta Physicochim. U.R.S.S. **8** (1938) 1-8
[C. A. **33**:2795[5], CAN 33:19239 / C. 1939 I, 4008].

- **Moscow (after 1937)**

  Hellmann's name could no longer be mentioned as a co-author of the following works, because of political reasons.

41. Н. Соколов (N. Sokolov; Moscow - 15 Jan 1938).
Применение к атомам теории Томаса-Ферми с дополнением Вайцзекера
[Application of the Thomas-Fermi theory as amplified by Weizsäcker to the statistic atomic model (in Russian)]
Zh. Eksp. Teor. Fiz. **8** (1938) 365-376
[CAN 33:37557].

42. С. Я. Пшежецкий (S. Ya. Pshezhetskii; Moscow - 19 Jan 1938).
Поляризуемость ионов в неоднородном поле и расчет энергии диссоциации ионных молекул
[The polarization of ions in an inhomogeneous field, and the calculation of the dissociation energy of ionic molecules (in Russian)]
Zh. Fiz. Khim. **11** (1938) 793-800
[CAN 33:43155].

43. М. А. Ковнер / M. A. Kovner (Moscow - 20 Mar 1942).
C. R. Acad. Sci. URSS 35 (1942) 197-199 (in Russian).
Quantum Theory of the Ammonia Molecule.
C. R. (Dokl.) Acad. Sci. URSS N.S. **35** (1942) 177-179
[CAN 37:11633].

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[1] W. H. E. Schwarz, J. Meister. Bibliography of Hans Hellmann 1925-1938. University of Siegen, 1993, unpublished.

[2] D. Andrae. Dissertation. University of Stuttgart, 1994, p. 99 (list of publications of Hans Hellmann, in German).

[3] W. H. E. Schwarz, D. Andrae, S. R. Arnold, J. Heidberg, H. Hellmann jr., J. Hinze, A. Karachalios, M. A. Kovner, P. C. Schmidt, L. Zülicke. Hans G. A. Hellmann (1903-1938). A Pioneer of Quantum Chemistry. Bunsen-Magazin, 1999, no. 1, 10-21, no. 2, 60-70 (in German, also available as translated version in English).

[4] The following standard reference sources have been used to retrieve information on publications of Hans Hellmann:
Chemical Abstracts (C. A.) Collective Author Indexes (1907-1916, 1917-1926,1927-1936, 1937-1946, 1947-1956) and Chemical Abstracts SciFinder™,
Science Abstracts A: Physics Abstracts (Sci. Abstr. A, up to volume **34**, 1931),
Chemisches Zentralblatt [German Abstracts from 1830 to 1969] (C., volumes **97** to **110**, 1925-1939).
None of these sources, if taken alone, provides a complete set of references to Hellmann's work.