

My scientific output — a commented bibliography

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Abstract

My scientific background and output is listed with brief comments. First they are presented in chronological order. Then they are ordered according to subject.

1 Introduction

This document summarizes my scientific output. First there is a short CV. Then some personal comments on what is different and original about my research. After that my work is listed in essentially chronological order. Finally the work is listed according to subject areas.

1.1 Curriculum vitae

- Born in Stockholm, Sweden, September 27 1948.
- Entered University of Stockholm, August 1967.
- Compulsory military service (10 months) 1968-69.

1.1.1 University degrees

- Fil. mag., Graduated from University of Stockholm, February 1 1973, Major subjects: Theoretical Physics, Mathematics, Physics Minor subjects: Astronomy, Philosophy.
- Fil. dr. (Ph. D.) at University of Stockholm May 19 1979, subject: Theoretical Physics, Title of dissertation: Topics in Molecular Mechanics.
- Docent ("oavlönad") of theoretical physics at the University of Stockholm, from February 27 1986.

1.1.2 Positions after Ph.D.

- Royal Society European Science Exchange Fellowship (10 months) 1979-80 at the Theoretical Chemistry department, University of Oxford.
- Research assistant at the Institute of Theoretical Physics, University of Stockholm, September to December 1980.
- Postdoctoral fellowship at Department of Chemistry, McMaster University (Hamilton, Ontario, Canada) with Prof. R. Bader (2 years) 1981 and 82.
- Minor jobs as research assistant at University of Stockholm and physics teacher at the Royal Institute of Technology (Stockholm) during 1983.
- Lecturer at the Department of Physics, University of Stockholm (half-time job) from January 1984 until June 1988 (full-time during the last 2 years).
- Lecturer at the Department of Quantum Chemistry, University of Uppsala (half-time job) Fall 1984 and 1985-86 (adding up to 1.5 years; held simultaneously with the position in Stockholm).
- Lecturer at the Department of Mechanics, Royal Institute of Technology, Stockholm (full, tenured position) from July 1988. Retired 1 September 2013.

1.1.3 Other appointments

- Director of undergraduate studies (Studierektor) at the Department of Mechanics, Royal Institute of Technology, from ca 1990-2012.
- On the Editorial Board of European Journal of Physics from September 2006.
- Chairman of the Swedish Sceptics for three years: 2008 April 19 2011 April 2.

1.1.4 Scepticism

I have been active in the Swedish Sceptics, Föreningen Vetenskap och Folkbildning, VoF (Society for Science and Popular Education), for many years. I have been on the board of the society from ca 1990 to 2011. For several years I was secretary and vice chairman of the board, then chairman for three years. I have written reviews and other articles for the journal Folkvett, published by the society (see: www.vof.se).

1.1.5 Intellectual heritage

My thesis advisor was Prof. Inga Fischer-Hjalmars. Other influential teachers of theoretical physics were Bertel Laurent, Stig Flodmark, and Stig Hjalmars. They were all to some extent students of Oskar Klein whose spirit was very much alive at the department. The main textbooks for graduate students of theoretical physics were, at the time of my graduate studies, the three first volumes of Landau and Lifshitz (Course of theoretical physics). These are thus the main influences that shaped my intellectual outlook.

1.2 The essentials of my work

Most of papers are technical papers that attempt to improve, clarify and, perhaps, simplify problems and issues that have been discussed in the scientific literature. Some of my papers however are more ambitious and attempt to change the basic outlook regarding certain problems. My first break with consensus science arose as a result of trying to understand superconductivity. After many attempts to understand the conventional view, that phonons provide a force that causes the superconducting transition, I reached the conclusion that this is not possible. The transition is caused by electromagnetic interactions and magnetic energy plays a crucial role. The role played by phonons is purely destructive. They ruin the long range correlation that is essential to the magnetic interaction and they thereby determine the transition (critical) temperature.

As a result of this finding I continued to investigate the magnetic interaction energy and came to the conclusion that it also is crucial for understanding plasma thermodynamics. The thermal equilibrium of a plasma will due to the long range magnetic interactions be a state with currents and magnetic fields. This appears to be a new point of view. It is not controversial, only completely unknown and ignored.

While studying magnetic energy Miguel Fiolhais and I came to the conclusion that the frequently occurring statement, that the Meissner effect has no classical explanation, is wrong. Another finding in this connection was that the so called Bohr-van Leeuwen theorem is only valid for small systems where one can neglect the magnetic fields generated by the particles of the system itself. Both these findings generated some controversy, but the careful theoretician will easily find the conclusions undisputable. The problem is that good theoretical physicists are not that common in some of the more applied areas of physics.

Finally I have participated in experimental studies of, so called, low energy nuclear reactions, sometimes referred to as "cold fusion". The existence of these phenomena is not currently recognized by the physics community, but the evidence to the contrary is growing rapidly.

2 Publications in chronological order

2.1 Output 1975-79, PhD-work, University of Stockholm

My first published scientific text is in the technical report [1] on numerical solution of coupled differential equations; in a preface I explain the physics behind the equations.

After that came the report [2] and the papers [3], [4], [5], which together with the report [6], were included in my PhD thesis [7]. They are all concerned with the classical and quantum mechanics of molecules, as is the follow up paper [8], published somewhat later.

2.2 Output 1980-89, post doctoral and substitute lecturer work

This decade includes first postdoctoral work done in Oxford and McMaster University, Hamilton, Ontario, then work done as substitute lecturer at the Department of Physics in Stockholm University (and to some extent Uppsala University). Here are the publications from the nineteeneighties in chronological order: [9], [10], [11], [12], [13], [14], [15], [16], [17], [18], [19], [20], [21], [22], [23], [24], [25], [26]. In the last of these the address is at KTH, but the work was done mainly at the university. This article represents the beginning of my interest in electromagnetism, in particular diamagnetism.

2.3 Output 1990-99, KTH

From here on my address is Department of Mechanics, KTH. My collaborations with Arne Nordmark as well as my work on the Darwin approach to electromagnetism begin. [27], [28], [29], [30], [31], [32], [33], [34], [35], [36], [37], [38], [39], [40], [41], [42].

2.4 Output 2000-09, KTH

Work on the Darwin approach continues. [43], [44], [45], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [57], [58], [59].

2.5 Output 2010-....., KTH

This decade coincides with my fruitful collaboration with Miguel Fiolhais. Contact with Johan C. Stén begins. [60], [61], [62], [63], [64], [65], [66], [67], [68], [69], [70], [71], [72], [73], [74], [75]. I also became involved with "cold fusion" or Low Energy Nuclear Reaction (LENR) research. [76], [77], [78].

2.6 Publications in Swedish

A few works published in Swedish deserve to be mentioned here: [79], [80], [81], [82], [83], [84], [85], [86]. I have also written a number of reviews that are too insignificant to list here.

3 Papers grouped according to subject

Here follows a classification of my publications according to subject. The same paper can appear under different headings.

3.1 Atomic, molecular and quantum theory

Papers on *atom-atom* and atom-diatom molecule interactions: [1], [2], [3], [16]. Papers on *vibration-rotation separation* problems in molecules: [5], [6], [8], [17], [30]. Papers on *electronic structure*, correlation, Born-Oppenheimer separation and similar stuff: [4], [11], [12], [15], [18], [19], [21], [24], [25]. Papers on *geometry* calculations (mainly for molecular applications): [13], [14], [20], [29], [36]. Papers dealing with *quantum theory* beyond applications to atoms and molecules: [5], [10].

The best papers by me among the above are [4], [8], and [25]. The far most cited paper is the review [18] of Richard Bader's atoms in molecules work.

3.2 Classical mechanics and Newtonian gravity

On foundations of mechanics: [31], [32], [66]. On rotation of non-rigid systems: [8], [9], [30]. Classical mechanics: [41], [44], [47], [54], [55], [58], [60], [61]. Special relativistic mechanics: [45]. Rotational flattening of astronomical bodies: [37], [72].

The highlights among these that are my own are [30], [66], and [72]. Work to which Arne Nordmark mainly contributed is of very high quality, especially [41] and [61].

3.3 General relativity

Papers on general relativity and related stuff: [10], [22], [23], [27], [28], [39], [66], [73], [74].

Of these paper I find [27] and [74], to be the most important.

3.4 Electromagnetism

A general review with focus on magnetic energy is [59], one of my best papers. Electromagnetism in general: [46]. Electrostatics can be found in the following publications: [15], [34], [40], [51], [53], [62]. Magnetostatics in:

[67]. Diamagnetism is discussed in: [26], [50], [62], [63], [64], [69], [71].

On charged particle motion: [49], [75] (an extended version of [46])

The best among these papers are [59] and [62].

3.5 Superconductivity, plasmas and the Darwin Lagrangian

This area has been a main research interest for a long time. Papers focusing on the Darwin Lagrangian and Hamiltonian are: [35], [38], [42], [48], [52], [56], [57], [59], [63]. Superconductivity is the main topic of: [33], [43], [50], [62], [64], [65], [68], [70], [71]. Plasma physics is the main topic of: [49], [51].

Highlights here are [33] on superconductivity, [35] on the Darwin Lagrangian and Hamiltonian, and [51] on the modification of the plasma frequency by inductive inertia.

3.6 Low energy nuclear reactions, LENR, or "cold fusion" research

My first study of the theoretical possibility to overcome the Coulomb barrier by means of the magnetic attraction of parallel current, or the "pinch effect", is in the arXiv-manuscript [52]. Later I became involved in empirical measurements of anomalous heat production in Andrea Rossi's Ecat reactors: [76], [77], [78]. This is from a purely practical application point of view the most exciting and important work I have been lucky to be allowed to participate in.

3.7 On the work in Swedish

My paper on the Periodic table [80] and my essay in favor of reductionism [86] are the ones I would like to recommend especially.

References

- [1] L. Edsberg, J. Oettelstrup, and Hanno Essén. Numerical solution of an initial value problem with complicated asymptotics: the curve-crossing problem in quantum chemistry. Technical Report TRITA-NA-7502, KTH, NADA, 1975.
- [2] Hanno Essén. Theoretical considerations of a curve-crossing in SiO responsible for an unusual type of predissociation. Technical Report USIP 76-17, University of Stockholm, Institute of Physics, 1976.
- [3] Hanno Essén, G. D. Billing, and M. Baer. Comparison of quantum mechanical and quasi-classical calculations of collinear reaction rate constants for the H+Cl₂ and D+Cl₂ systems. *Chem. Phys.*, 17:443–449, 1976.

- [4] Hanno Essén. The physics of the Born-Oppenheimer approximation. *Int. J. of Quant. Chem.*, 12:721–735, 1977.
- [5] Hanno Essén. Quantization and independent coordinates. *Am. J. Phys.*, 46:983–988, 1978.
- [6] Hanno Essén. Some studies concerning vibration-rotation of polyatomic molecules. Technical Report USIP 78-21, University of Stockholm, Institute of Physics, 1978.
- [7] Hanno Essén. *Topics in Molecular Mechanics*. PhD thesis, University of Stockholm, Institute of Physics, 1979.
- [8] Hanno Essén. Vibration-rotation coupling in polyatomic molecules: Additions to the Eckart conditions. *Chem. Phys.*, 44:378–388, 1979.
- [9] Hanno Essén. The cat landing on its feet revisited or angular momentum conservation and torque-free rotations of non-rigid mechanical systems. *Am. J. Phys.*, 49:756–758, 1981.
- [10] Hanno Essén. Particle kinematics in a unified geometric description of all fields. *Il Nuovo Cimento B*, 66:1–8, 1981.
- [11] Hanno Essén. The periodic table of the elements and the Thomas-Fermi atom. *Int. J. of Quant. Chem.*, 21:717–726, 1982.
- [12] T. T. Nguyen-Dang, R. F. W. Bader, and Hanno Essén. Some properties of the Lagrange multiplier in density functional theory. *Int. J. of Quant. Chem.*, 22:1049–1058, 1982.
- [13] Hanno Essén. EUCLID: An interactive system for calculations relating to molecular geometries. QCPE-program 452. *QCPE Bulletin, Quantum Chemistry Program Exchange*, 3(1):13, 1983.
- [14] Hanno Essén. On the general transformation from molecular geometric parameters to Cartesian coordinates. *J. Comput. Chem.*, 4:136–141, 1983.
- [15] Hanno Essén. The effective shell charge of electrons on a sphere: A discussion of Hund’s rules, negative ions and the chemical bond. *Theor. Chim. Acta*, 63:365–376, 1983.
- [16] M. S. Child, Hanno Essén, and R. J. Le Roy. An RKR-like inversion procedure for bound-continuum transition intensities. *J. Chem. Phys.*, 78:6732–6740, 1983.
- [17] Hanno Essén. Kinematic and dynamic partitionings of the energy: Coordinate and other transformations. In J. Hinze, editor, *Energy Storage*

- and Redistribution in Molecules*, pages 327–336. Plenum, New York, 1983.
- [18] R. F. W. Bader and Hanno Essén. On the characterization of atomic interactions. *J. Chem. Phys.*, 80:1943–1960, 1984.
- [19] R. F. W. Bader and Hanno Essén. The mechanics of and an equation for the electronic charge density. In J. P. Dahl and J. Avery, editors, *Local Density Approximations in Quantum Chemistry and Solid State Physics*, pages 129–144. Plenum, New York, 1984.
- [20] Hanno Essén and Dieter Cremer. On the relationship between the mean plane and the least-squares plane of an n-membered puckered ring. *Acta Crystallographica B*, 40:418–420, 1984.
- [21] Hanno Essén. Correlation with independent particle orbitals. *Int. J. of Quant. Chem.*, 30:89–95, 1986.
- [22] Hanno Essén and L. Hörnfeldt. Curvature of n-dimensional ellipsoids embedded in R^{n+1} . Abstracts of contributed papers, 11th international conference on general relativity and gravitation, Stockholm, Sweden, abstract no 1:12 (supplementary volume), July 6-12 1986.
- [23] Hanno Essén. Space-time curvature and the sources of gravity. *Eur. J. Phys.*, 8:182–185, 1987.
- [24] Jan Blomquist and Hanno Essén. Correlation and the charge distribution of atoms. *Chem. Phys.*, 112:173–177, 1987.
- [25] Hanno Essén. A new completely separable molecule-like fourbody system. *Phys. Lett. A*, 133:56–58, 1988.
- [26] Hanno Essén. Magnetic fields, rotating atoms, and the origin of diamagnetism. *Phys. Scr.*, 40:761–767, 1989.
- [27] Hanno Essén. General relativity as a conformally invariant scalar gauge field theory. *Int. J. Theor. Phys.*, 29:183–187, 1990.
- [28] Hanno Essén. Empirical and theoretical evidence for gravitational polarization of matter. *Phys. Scr.*, 45:22–25, 1992.
- [29] Hanno Essén. A guide to evclid, the geometric calculator. Technical Report TRITA-MEK Technical Report 1992:1, KTH, Department of Mechanics, 1992.
- [30] Hanno Essén. Average angular velocity. *Eur. J. Phys.*, 14:201–205, 1993.

- [31] Hanno Essén. *Basic Mechanics – The Science and its Applications*. Teknisk Högskolelitteratur i Stockholm AB, 1993.
- [32] Hanno Essén. On the geometry of non-holonomic dynamics. *J. Appl. Mech.*, 61:689–694, 1994.
- [33] Hanno Essén. A study of lattice and magnetic interactions of conduction electrons. *Phys. Scr.*, 52:388–394, 1995.
- [34] Hanno Essén and Arne B. Nordmark. Some results on the electrostatic energy of ionic crystals. *Can. J. Chem.*, 74:885–891, 1996.
- [35] Hanno Essén. Darwin magnetic interaction energy and its macroscopic consequences. *Phys. Rev. E*, 53:5228–5239, 1996.
- [36] Hanno Essén and Mats Svensson. Calculation of coordinates from molecular geometric parameters and the concept of a geometric calculator. *Computers & Chemistry*, 20:389–395, 1996.
- [37] Hanno Essén. A simple mechanical model for the shape of the Earth. *Eur. J. Phys.*, 17:131–135, 1996.
- [38] Hanno Essén. Phase-space energy of charged particles with negligible radiation: Proof of spontaneous formation of magnetic structures and new effective forces. *Phys. Rev. E*, 56:5858–5865, 1997.
- [39] Hanno Essén. The interior Schwarzschild problem and its integration. *Int. J. Theor. Phys.*, 37:875–889, 1998.
- [40] Hanno Essén. The field outside a spherical 2^l -pole distribution is a pure 2^l -pole field. *Am. J. Phys.*, 66:163–163, 1998.
- [41] Arne Nordmark and Hanno Essén. Systems with a preferred spin direction. *Proc. Roy. Soc. A, Mathematical and Physical Sciences*, 455:933–941, 1999.
- [42] Hanno Essén. Magnetism of matter and phase-space energy of charged particle systems. *J. Phys. A: Math. Gen.*, 32:2297–2314, 1999.
- [43] Hanno Essén. Circulating electrons, superconductivity, and the Darwin-Breit interaction. E-print arXiv:cond-mat/0002096v1 [cond-mat.supr-con], February 2000.
- [44] Hanno Essén. On the equilateral triangle solutions to the three-body problem. *Eur. J. Phys.*, 21:579–590, 2000.
- [45] Hanno Essén. Note on the relativistic elastic head-on collision. *Eur. J. Phys.*, 23:565–568, 2002.

- [46] Hanno Essén. The pushing force of a propagating electromagnetic wave. E-print: arXiv:physics/0308007v1 [physics.class-ph], August 2003.
- [47] Karl I. Borg, Lars H. Söderholm, and Hanno Essén. Force on a spinning sphere moving in a rarefied gas. *Physics of Fluids*, 15:736–741, 2003.
- [48] Hanno Essén and Arne B. Nordmark. Hamiltonian of a homogeneous two-component plasma. *Phys. Rev. E*, 69:036404–1–9, 2004.
- [49] Hanno Essén. Magnetohydrodynamic self-consistent exact helical solutions. *J. Phys. A: Math. Gen.*, 37:9831–9840, 2004.
- [50] Hanno Essén. Electrodynamics model connecting superconductor response to magnetic field and to rotation. *Eur. J. Phys.*, 26:279–285, 2005.
- [51] Hanno Essén. Magnetic dynamics of simple collective modes in a two-sphere plasma model. *Phys. of Plasmas*, 12:122101–1–7, 2005.
- [52] Hanno Essén. Catalyzing fusion with relativistic electrons. E-print: arXiv:physics/0607138v1 [physics.plasm-ph], July 2006.
- [53] Hanno Essén. Electrostatic interaction energies of homogeneous cubic charge distributions. E-print: arXiv:physics/0701215v1 [physics.atm-clus], January 2007.
- [54] Arne Nordmark and Hanno Essén. The skipping rope curve. *Eur. J. Phys.*, 28:241–247, 2007.
- [55] Hanno Essén. Matrix analysis of coupled damped vibrations — two degree-of-freedom analytic solution. *International Journal of Pure and Applied Mathematics*, 36:115–146, 2007.
- [56] Hanno Essén. The exact Darwin Lagrangian. *EPL*, 79:6002–1–3, 2007.
- [57] Hanno Essén. Magnetic energy per particle in constant current density. *EPL*, 84:20011–1–5, 2008.
- [58] Hanno Essén and Nicholas Apazidis. Turning points of the spherical pendulum and the golden ratio. *Eur. J. Phys.*, 30:427–432, 2009.
- [59] Hanno Essén. From least action in electrodynamics to magnetomechanical energy — a review. *Eur. J. Phys.*, 30:515–539, 2009.
- [60] Hanno Essén and Arne B. Nordmark. Static deformation of heavy spring due to gravity and centrifugal force. *Eur. J. Phys.*, 31:603–609, 2010.

- [61] Arne B. Nordmark and Hanno Essén. The comfortable roller coaster — on the shape of tracks with a constant normal force. *Eur. J. Phys.*, 31:1307–1317, 2010.
- [62] M. C. N. Fiolhais, Hanno Essén, C. Providentia, and A. B. Nordmark. Magnetic field and current are zero inside ideal conductors. *Prog. Electromagn. Res. B (USA)*, 27:187–212, 2011.
- [63] Hanno Essén. Classical diamagnetism, magnetic interaction energies, and repulsive forces in magnetized plasmas. *EPL*, 94:47003–1–5, 2011.
- [64] Hanno Essén and Miguel C. N. Fiolhais. Meissner effect, diamagnetism, and classical physics—a review. *Am. J. Phys.*, 80:164–169, 2012.
- [65] M. C. N. Fiolhais and Hanno Essén. Electromagnetic wave scattering by a superconductor. *EPL*, 97:4406–1–3, 2012.
- [66] Hanno Essén. Mechanics, cosmology, and Mach’s principle. *Eur. J. Phys.*, 34:139–145, 2013.
- [67] Hanno Essén, Johan C.-E. Sten, and A. B. Nordmark. Magnetic energy of surface currents on a torus. *Prog. Electromagn. Res. B (USA)*, 46:357–378, 2013.
- [68] M. C. N. Fiolhais and Hanno Essén. Electrodynamics of perfect conductors. *Int. J. Theor. Phys.*, 52:1701–1705, 2013. DOI: 10.1007/s10773-013-1491-9.
- [69] M. C. N. Fiolhais and Hanno Essén. Magnetic field expulsion in perfect conductors – the magnetic equivalent of Thomson’s theorem. In *PIERS Proceedings, Stockholm, Sweden, Aug. 12-15*, pages 1198–1202, 2013.
- [70] Hanno Essén and M. C. N. Fiolhais. The Darwin-Breit magnetic interaction and superconductivity. In *PIERS Proceedings, Stockholm, Sweden, Aug. 12-15*, pages 1193–1197, 2013.
- [71] M. C. N. Fiolhais and Hanno Essén. Magnetic field expulsion from an infinite cylindrical superconductor. *Physica C*, 497:54–57, 2014. DOI 10.1007/s10773-013-1491-9.
- [72] Hanno Essén. The physics of rotational flattening in the point core model. *International Journal of Geosciences*, 5:555–570, 2014. DOI 10.4236/ijg.2014.56051.
- [73] Hanno Essén. Gravitationally bound ideal gas sphere in Newtonian and in Einsteinian gravity. *Eur. J. Phys.*, 35:065003–1–8, 2014.

- [74] Hanno Essén. Gravitational Lagrangians, Mach's principle, and the equivalence principle in an expanding universe. *Journal of Gravity*, 2014:415649–1–5, 2014.
- [75] Hanno Essén and Johan C.-E. Stén. A new look at the pushing force of an electromagnetic wave on a classical charged particle. *Eur. J. Phys.*, 36:055029–1–14, 2015.
- [76] Sven Kullander and Hanno Essén. Experimental test of a mini-Rossi device at the Leonardocorp, April 2011. Published by the Swedish periodical Ny Teknik. Can be found at: http://www.mech.kth.se/hanno/Bologna_report.pdf.
- [77] Giuseppe Levi, Evelyn Foschi, Torbjörn Hartman, Bo Höistad, Roland Pettersson, Lars Tegnér, and Hanno Essén. Indication of anomalous heat energy production in a reactor device. E-print arXiv:1305.3913 [physics.gen-ph], June 2013.
- [78] Giuseppe Levi, Evelyn Foschi, Bo Höistad, Roland Pettersson, Lars Tegnér, and Hanno Essén. Observation of abundant heat production from a reactor device and of isotopic changes in the fuel, October 2014. Published by the organization Elforsk. Can be found at: http://www.elforsk.se/Global/Omv%C3%A4rld_system/filer/LuganoReportSubmit.pdf.
- [79] Hanno Essén. Att generalisera Fermats hypotes. *Elementa*, 68:61–62, 1985.
- [80] Hanno Essén. Periodiska systemets rätta form. *Elementa*, 72:17–20, 1989.
- [81] Arne B. Nordmark and Hanno Essén. Hopprenskurvan. *Elementa*, 79:142–148, 1996.
- [82] Hanno Essén. Evighetsmaskiner och drömmen om fri energi. In J. Jerkert and S.-O. Hansson, editors, *Vetenskap eller villfarelse*, pages 59–76. Leopard, Stockholm, 2005.
- [83] Hanno Essén. Tomtar, troll och currykryss. In J. Jerkert, editor, *Fakta eller fantasier*, pages 106–112. Leopard, Stockholm, 2007.
- [84] Hanno Essén. Folk, filosofer och fysik. In J. Jerkert, editor, *Fakta eller fantasier*, pages 113–119. Leopard, Stockholm, 2007.
- [85] Hanno Essén. Incidenter i fysikens historia. *Folkvett*, 2007(3):33–52, 2007.
- [86] Hanno Essén. Reduktionism och andra ismer. *Folkvett*, 2009(4):28–39, 2009.