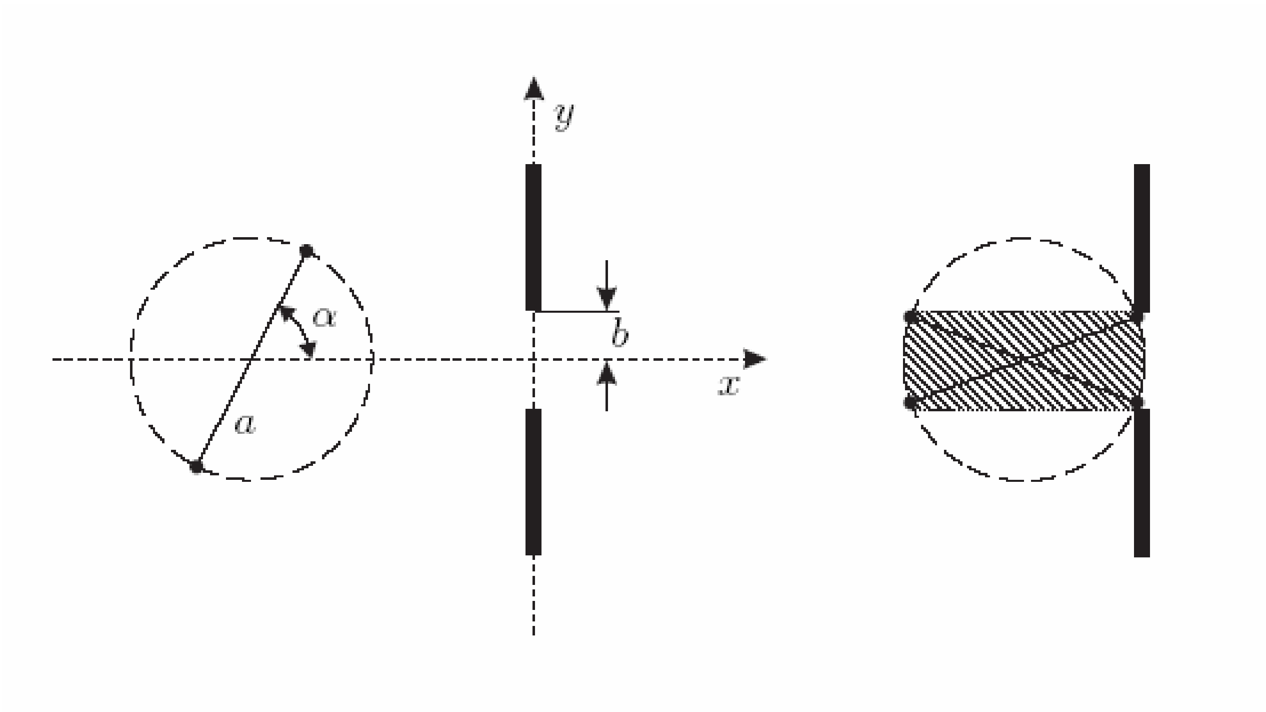
Quantum Ulm Sparrow

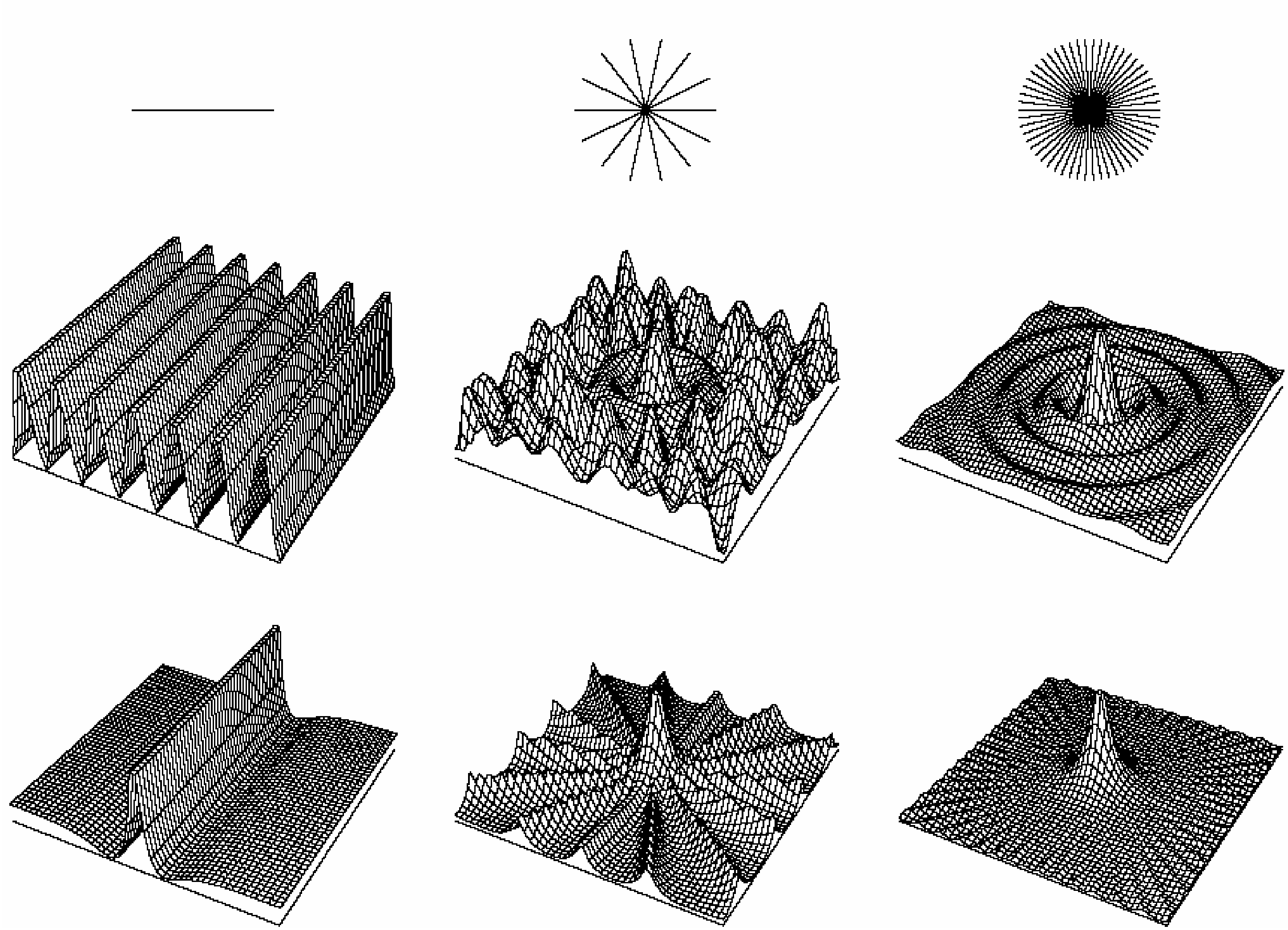
Wolfgang Schleich
Abteilung für Quantenphysik
Universität Ulm

Classical Ulm Sparrow

Quantum Ulm Sparrow



s-waves: free particle and hydrogen



Collaborations : O. Crasser, C. Feiler, and A. Wolf (Universität Ulm)
V. Pokrovsky (Texas A&M)
G. Süßmann (Universität München)

Overview

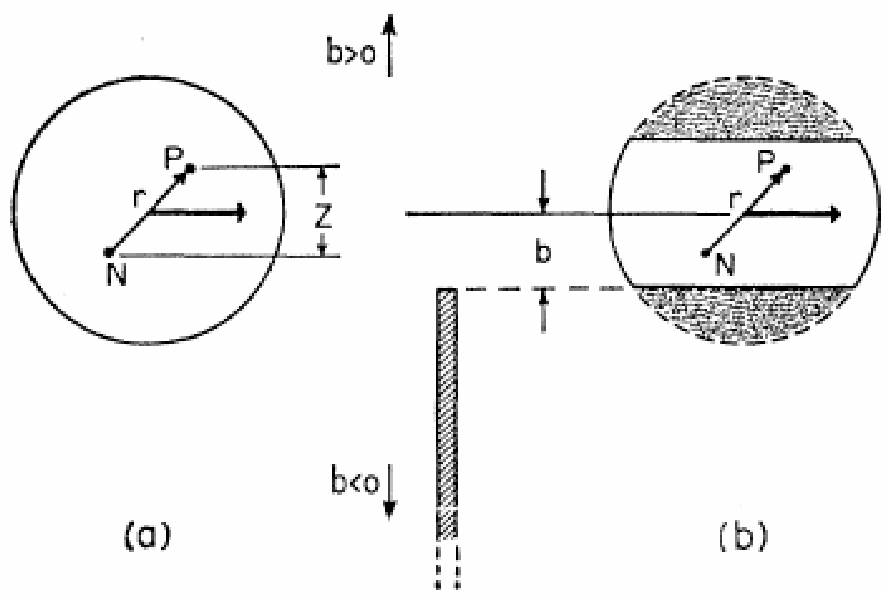
- Formulation of problem
- Scattering of particles with structure
- Potentials from boundary conditions
- Quantum Ulm Sparrow
- Unusual bound states

PHYSICAL REVIEW VOLUME 99, NUMBER 5 SEPTEMBER 1, 1955

Deuteron Stripping Processes at High Energies

R. J. GLAUBER
Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts
(Received May 12, 1955)

The processes which lead to the formation of stripped particle beams in encounters of high-energy deuterons with heavy nuclei are discussed. It is shown that a significant role is played by a previously unnoticed dissociation process arising from diffractive effects in which, from a classical standpoint, the particles suffer no collisions.



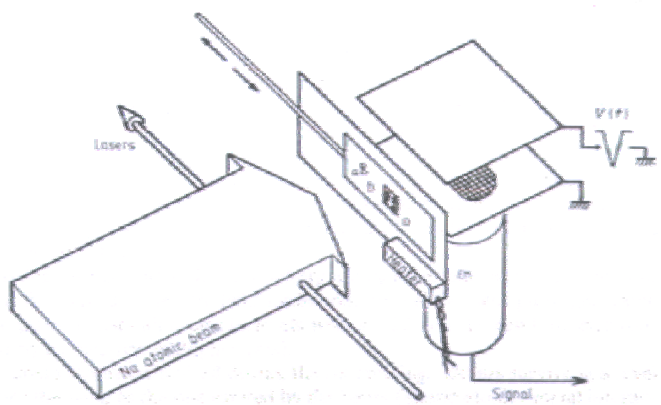
J. Phys. B: At. Mol. Phys. 16 (1983) L671–L677. Printed in Great Britain

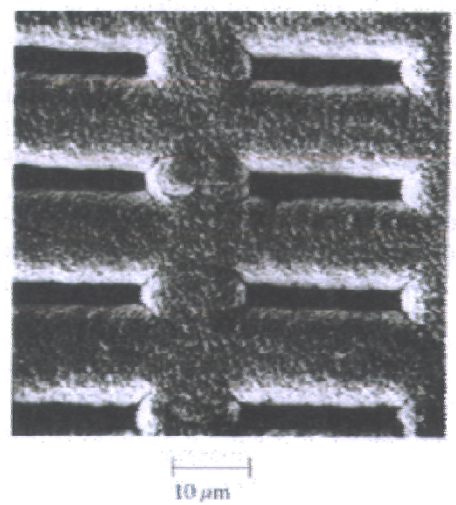
LETTER TO THE EDITOR

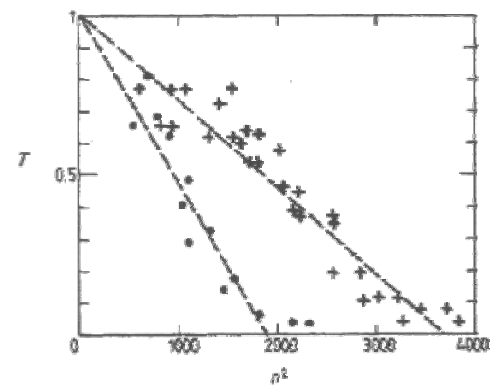
Measuring atomic dimensions by transmission of Rydberg atoms through micrometre size slits

C Fabre, M Gross, J M Raimond and S Haroche

Laboratoire de Spectroscopie Hertzienne de l'Ecole Normale Supérieure, 24, rue Lhomond, 75231 Paris Cédex 05, France







Wave Nature of Biomolecules and Fluorofullerenes

Lucia Hackermüller, Stefan Uttenthaler, Klaus Hornberger, Elisabeth Reiger, Björn Brezger,*
Anton Zeilinger, and Markus Arndt
Institut für Experimentalphysik, Universität Wien, Boltzmanngasse 5, A-1090 Wien, Austria†
(Received 7 April 2003; published 28 August 2003)

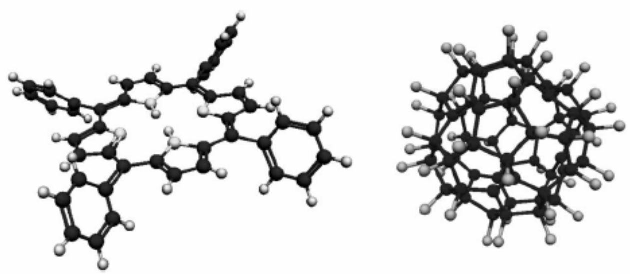
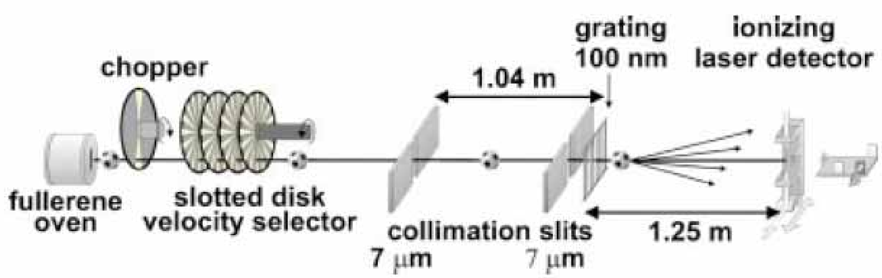


FIG. 1. 3D structure of tetraphenylporphyrin (TPP) $C_{44}H_{30}N_4$ (left) and the fluorofullerene $C_{60}F_{48}$ (right) [10]. TPP ($m = 614$ amu) is composed of four tilted phenyl rings attached to a planar porphyrin structure. The fluorofullerene ($m = 1632$ amu) is a deformed C_{60} cage surrounded by a shell of 48 fluorine atoms. Only an isomer with D_3 symmetry is drawn here.



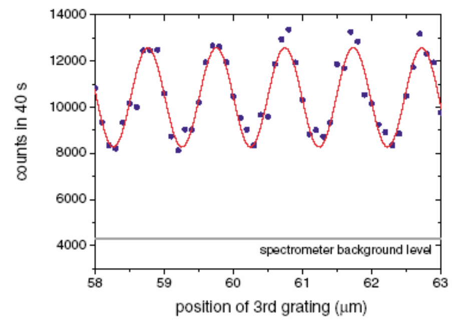


FIG. 2 (color online). De Broglie near-field interference fringes of meso-tetraphenylporphyrin (TPP)

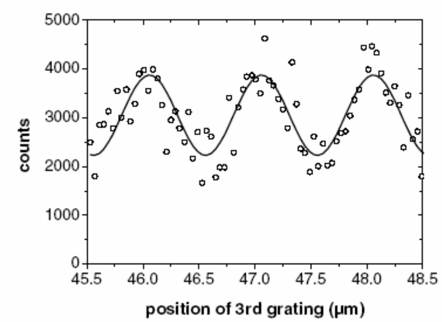


FIG. 4. Quantum interference fringes of $C_{60}F_{48}$. The beam

Determination of the Bond Length and Binding Energy of the Helium Dimer by Diffraction from a Transmission Grating

R. E. Grisenti, W. Schöllkopf, and J. P. Toennies
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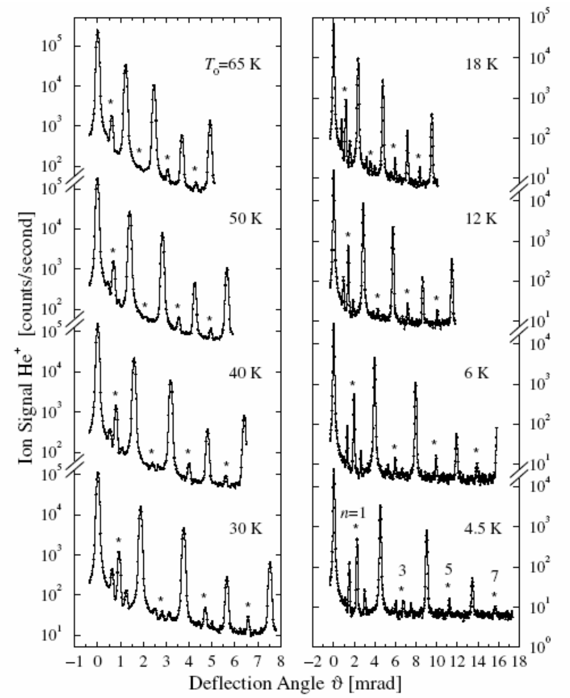
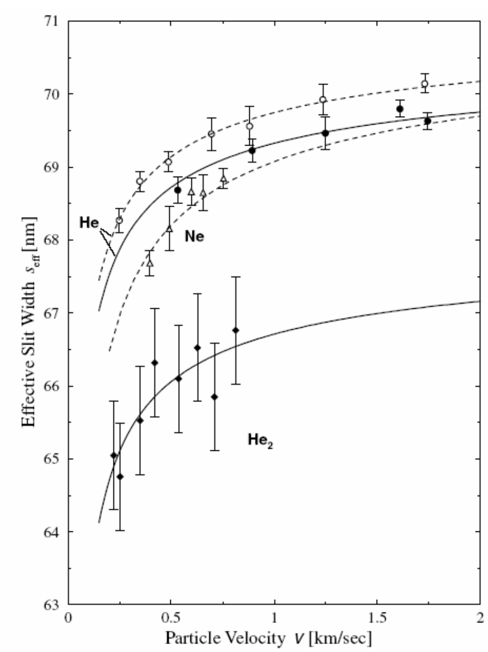
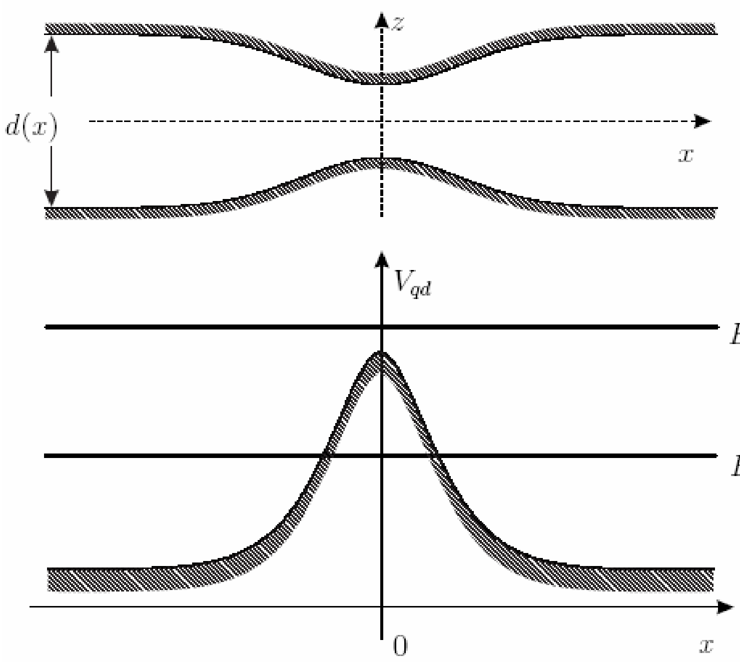
G. C. Hegerfeldt, T. Köhler, and M. Stoll
Institut für Theoretische Physik, Universität Göttingen, Bunsenstraße 9, 37073 Göttingen, Germany
(Received 5 June 2000)

A molecular beam consisting of small helium clusters is diffracted from a 100 nm period transmission grating. The relative dimer intensities have been measured out to the 7th order and are used to determine the reduction of the effective slit width resulting from the finite size of the dimer. From a theoretical analysis of the data which also takes into account the van der Waals interaction with the grating bars, the bond length (mean internuclear distance) and the binding energy are found to be $\langle r \rangle = 52 \pm 4$ Å and $|E_b| = 1.1 + 0.3/-0.2$ mK.





Narrowing wave guide



$$\left(\frac{\hat{p}_x^2}{2M}+\frac{\hat{p}_z^2}{2M}\right)v(x,z)=E\,v(x,z)$$

$$v(x,z)=\cos\left(\frac{\pi z}{d(x)}\right)\chi(x)$$

$$\left(\frac{\hat{p}_x^2}{2M}+V_{qb}(x)\right)\chi(x)=E\,\chi(x)$$

$$V_{qb}(x)\equiv\frac{\hbar^2\pi^2}{2Md(x)^2}$$

PHYSICAL REVIEW E VOLUME 48, NUMBER 1 JULY 1993

Evanescent-mode propagation and quantum tunneling

A. Enders and G. Nimtz
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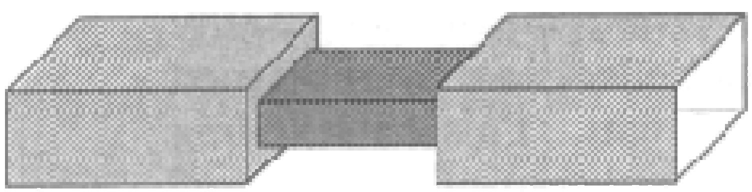
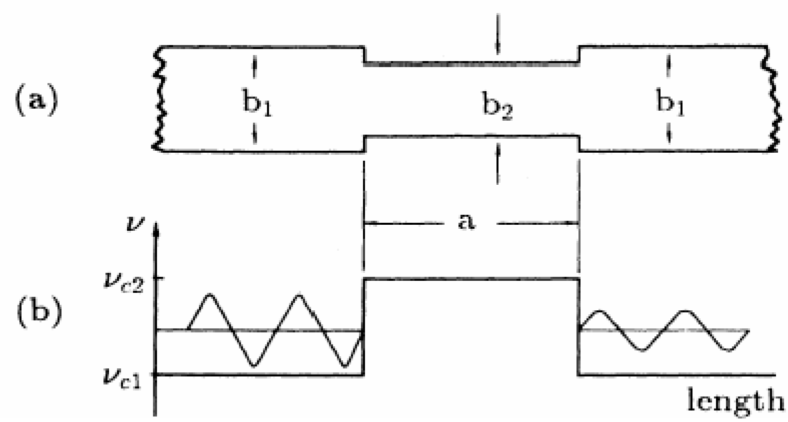
(Received 4 November 1992)

The tunneling of particles is in direct analogy with the transmission of evanescent electromagnetic waveguide modes as has been shown quite recently. We compare experimental data of an electromagnetic wave packet traversing an evanescent waveguide region with theoretical values derived for particle tunneling through a rectangular potential barrier. The transmission time was deduced by transformation of the experimental frequency data to the time domain. The data are in agreement and reveal superluminal wave-packet velocities for opaque evanescent regions.





Physica B 151 (1988) 374–377
North-Holland, Amsterdam

A NEW NON-LOCAL EFFECT IN QUANTUM MECHANICS

Daniel M. GREENBERGER
City College of the City University of New York, New York, NY 10031, USA

The Aharonov–Bohm effect affords a beautiful insight into the non-local nature of quantum theory. Unfortunately, because of the topological aspects to that effect, which are quite fascinating in their own right, there is an unfortunate tendency to connect these two independent elements. The present effect exhibits the non-locality, free of topological considerations, although it is related to the Berry phase, another much-discussed recent phenomenon. The effect consists of keeping a particle confined to a small region of a box with infinite walls. If the wall of the box is moved, then even though the particle is nowhere near the wall, it will experience a phase shift, which in principle is subject to experimental verification.

Volume 125, number 9 PHYSICS LETTERS A 7 December 1987

A GEOMETRICAL QUANTUM PHASE EFFECT ☆

Jean-Marc LÉVY-LEBLOND
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Received 4 October 1987; accepted for publication 9 October 1987
Communicated by J.P. Vigier

A localized change in the spatial boundary conditions of a propagating quanton in shown to modify the phase of its outgoing wavefunction. This elementary effect is in principle observable by neutron interferometry, and gives rise to a purely geometrical analog of the Aharonov–Bohm effect, which puts into full light the nonlocal character of quantum behaviour.

Measurement of a confinement induced neutron phase

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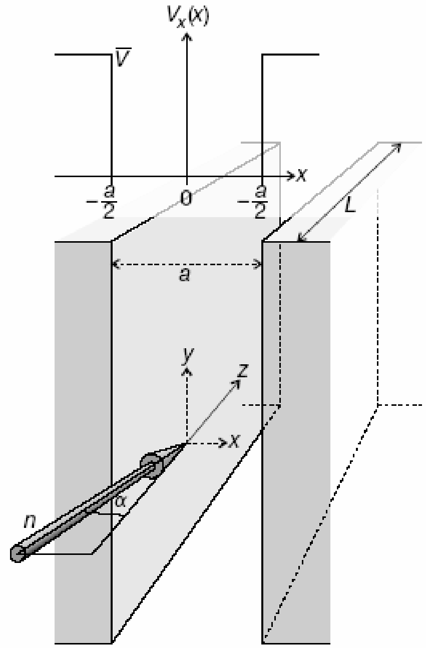
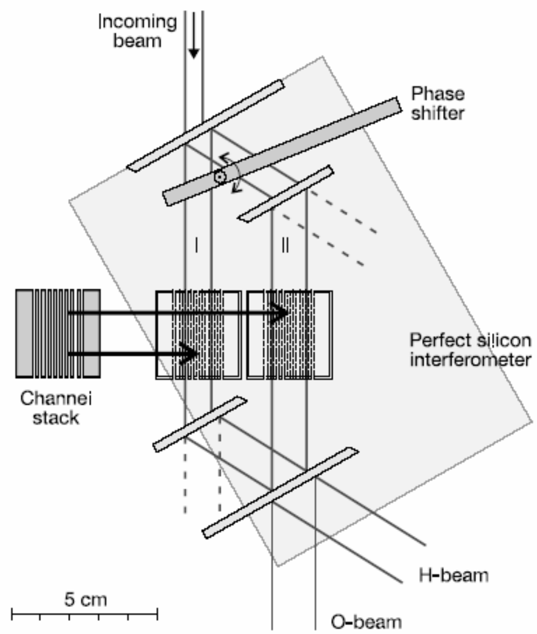
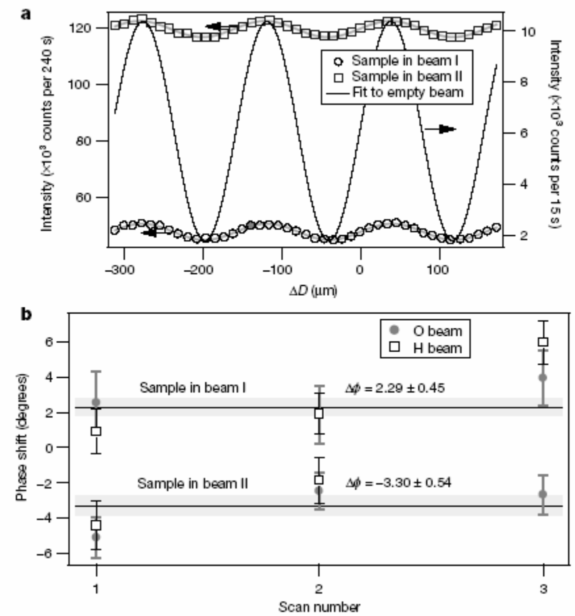
** Atominstitut der Österreichischen Universitäten, A-1020 Wien, Austria*
† Institut Laue-Langevin, BP 156, F-38042 Grenoble, France







EUROPHYSICS LETTERS

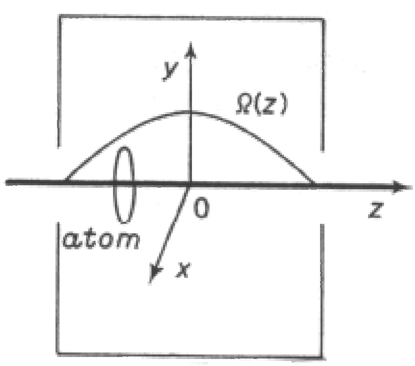
1 January 1991

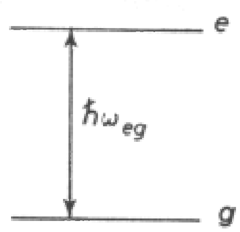
Europhys. Lett., 14 (1), pp. 19-24 (1991)

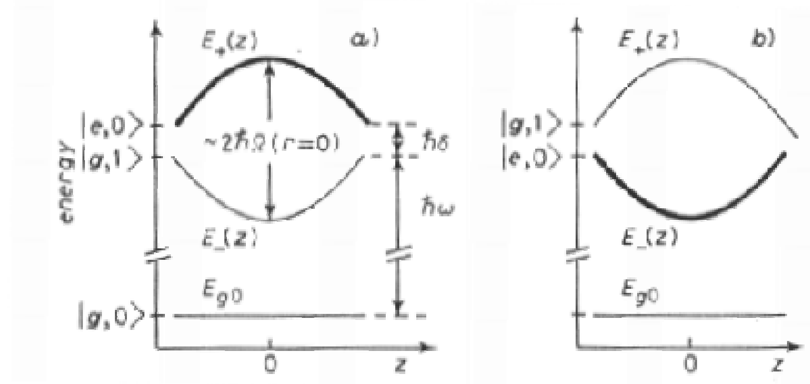
Trapping Atoms by the Vacuum Field in a Cavity.

S. HAROCHE, M. BRUNE and J. M. RAIMOND

Département de Physique de l'Ecole Normale Supérieure
Laboratoire de Spectroscopie Hertzienne (*)
24 rue Lhomond, F-75231 Paris Cedex 05, France

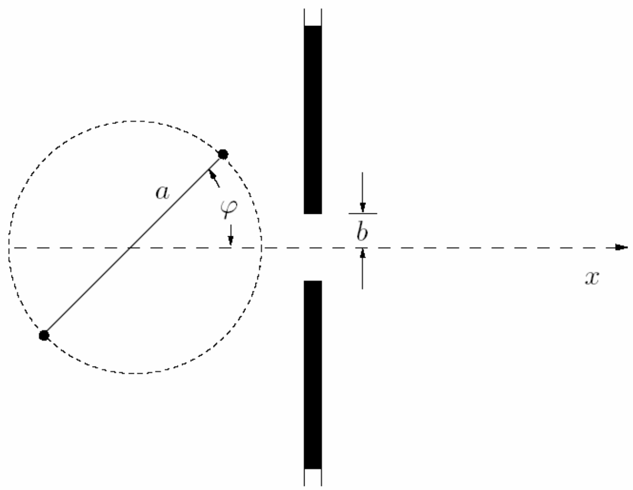


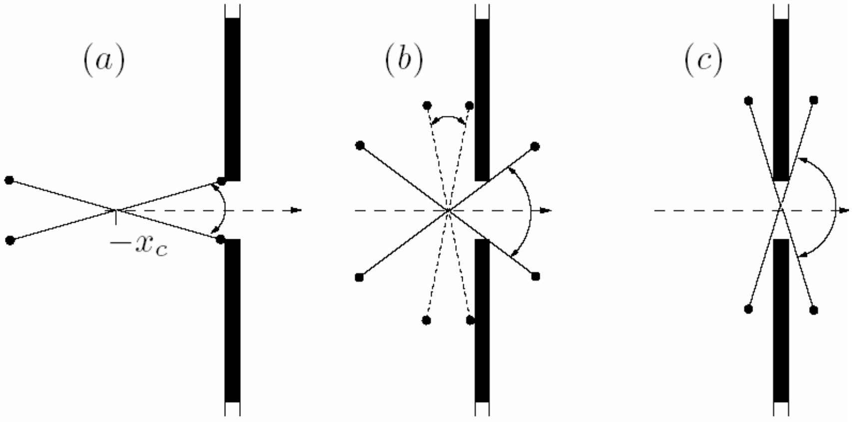


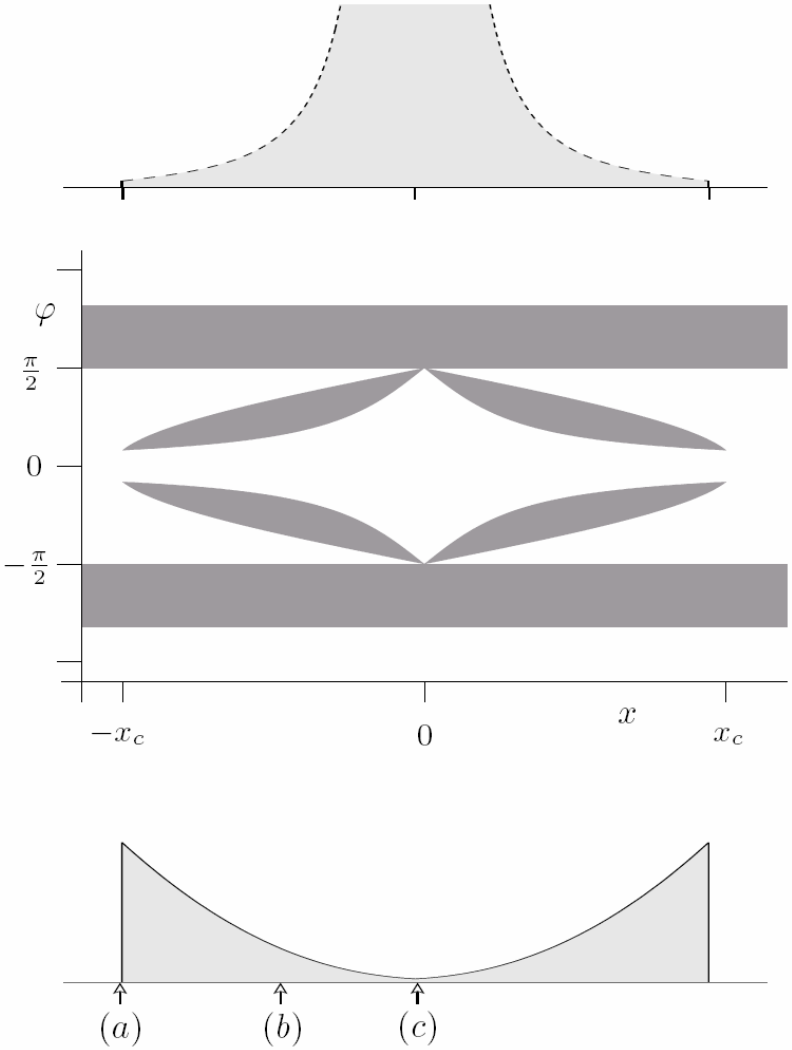


See also Englert et. al., Europhys. Lett.**14**, 25 (1991)

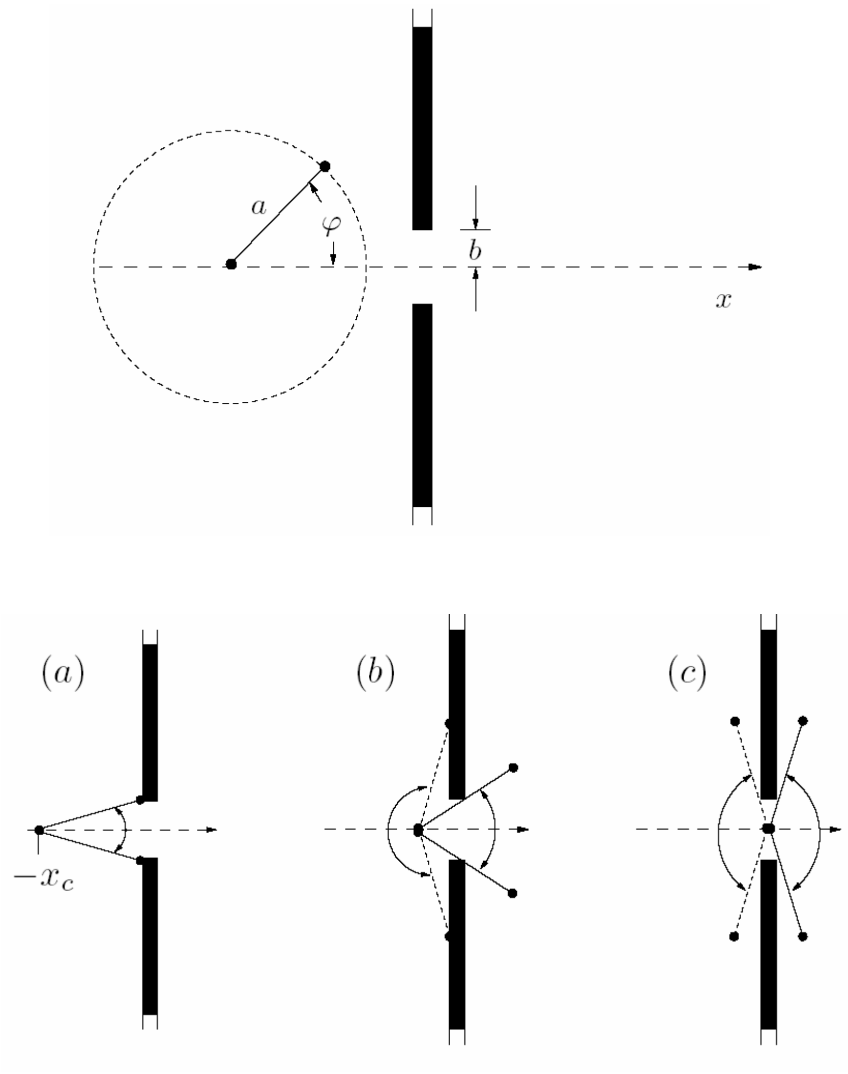
Scattering of symmetric rotor

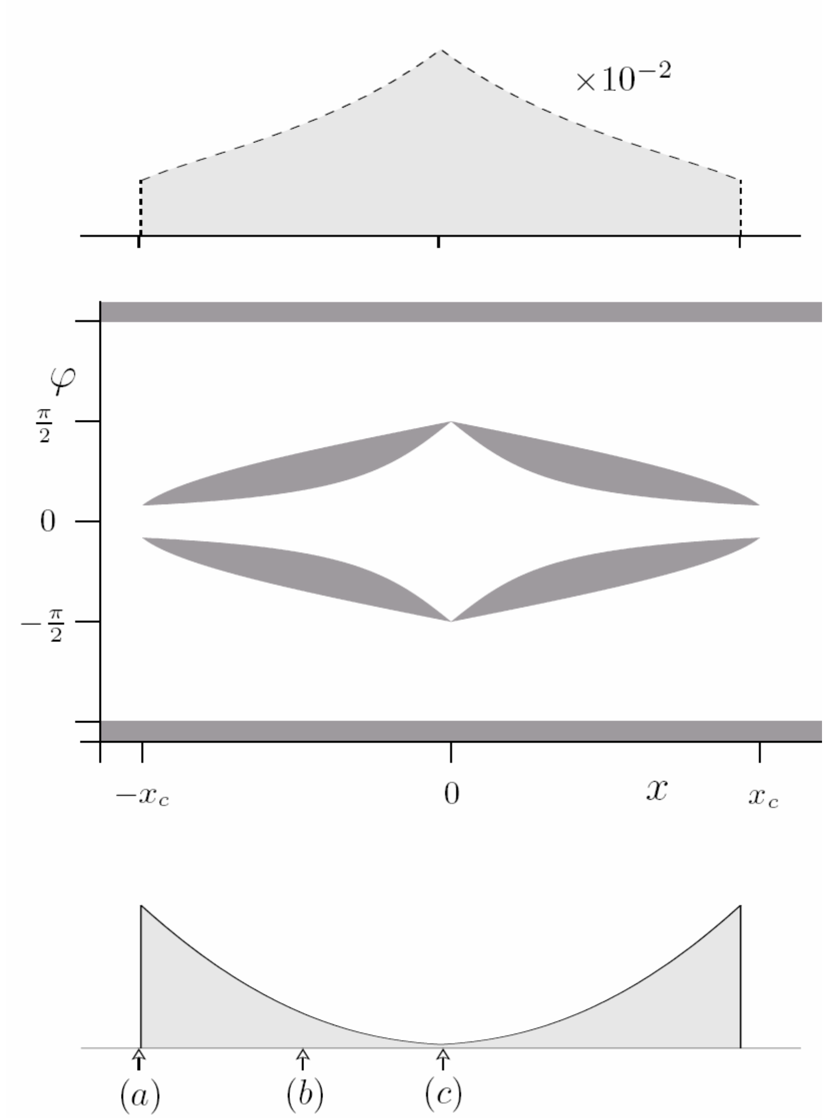




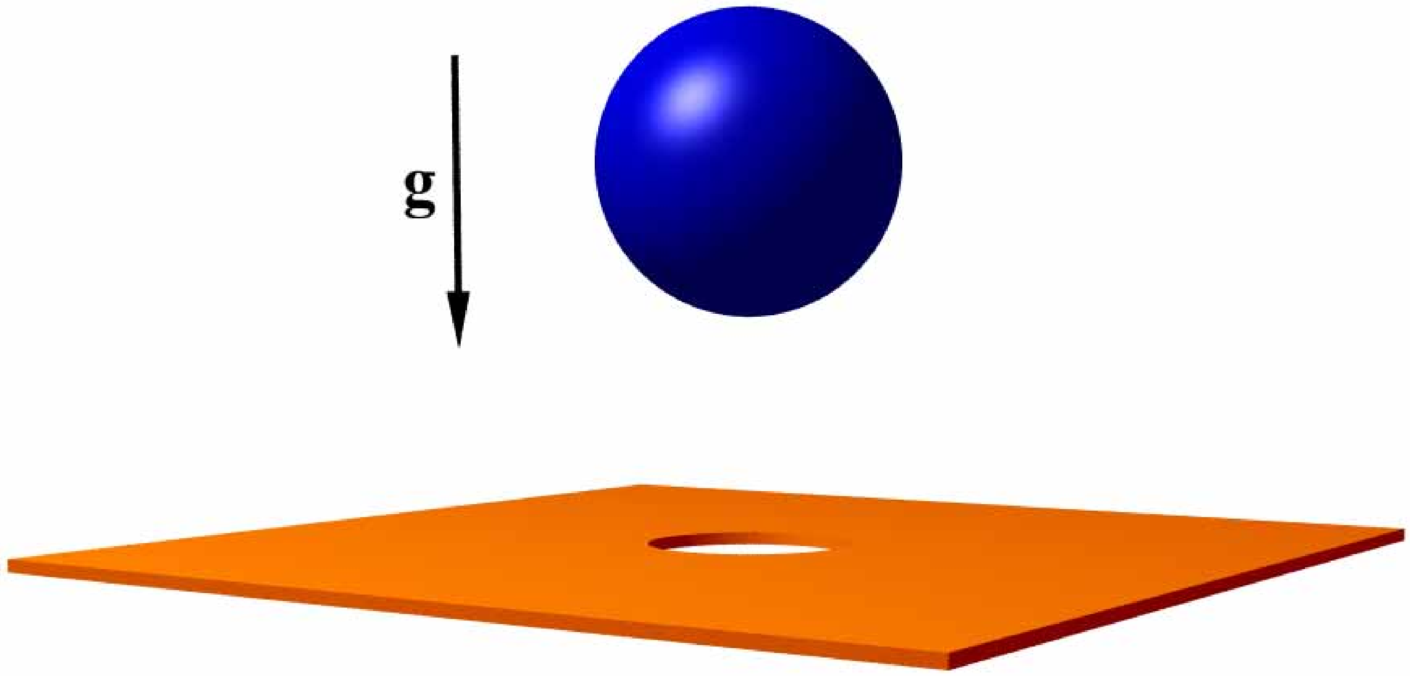


Scattering of asymmetric rotor





Levitation of a BEC



Letters to the Editor

On the Einstein Condensation Phenomenon*

W. E. LAMB, JR. AND A. NORDSIECK
Columbia University, New York, New York
March 29, 1941

IN a recent paper, L. Goldstein[1] has discussed the behavior of an ideal Bose-Einstein gas in the presence of an external force field.

If instead, one considers the discrete character of the energy spectrum for the lowest states in the potential field present, one finds that the condensed phase is all to be found in the lowest quantum state for the vertical motion, and that the thickness of the layer on the floor is of the order

$$t = 1.8(\hbar^2/m^2g)^{\frac{1}{3}}$$

(as may be estimated with sufficient accuracy by the WKB method) where g is the acceleration due to gravity, m is the mass of the atom. It is assumed here that the height of the box is large compared with t. For helium in the earth's gravitational field, one finds $t = 5.5 \times 10^{-3}$ cm, a small but not microscopic distance. At a height $z > t_g$, the density falls off proportionally to $\exp -4.8[(z-t)/t]^{\frac{3}{2}}$.

PHYSIKALISCHE ZEITSCHRIFT

vereinigt mit dem

JAHRBUCH DER RADIOAKTIVITÄT UND ELEKTRONIK

Nr. 15 | 1. August 1929 | 30. Jahrgang

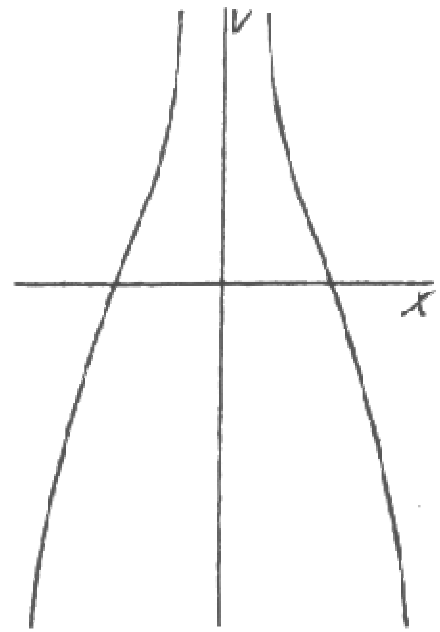
Redaktionsschluß für Nr. 17 am 15. August 1929.

$$-\frac{h^2}{8\pi^2 m}\Delta\psi + (V(r) - E)\psi = 0$$

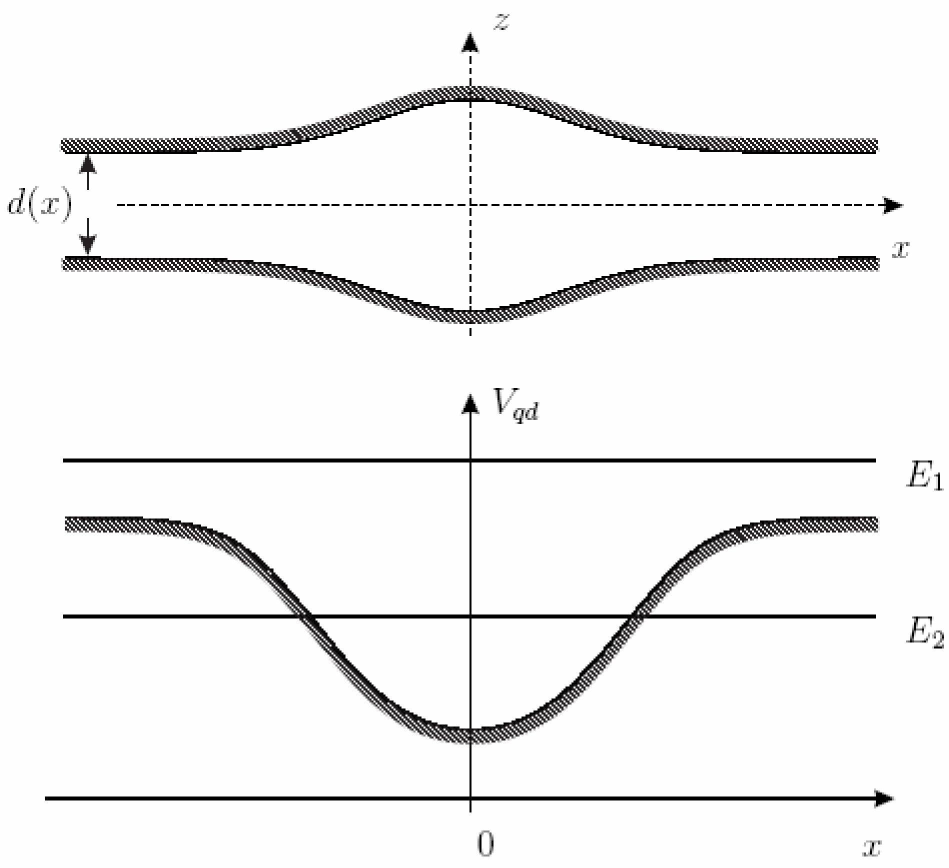
$$V = \frac{h^2}{8\pi^2 m}\left(\frac{\psi''}{\psi} + \frac{2\psi'}{r\psi}\right)$$

$$\psi = \frac{\sin(r^3)}{r^2}$$

$$V = 2r^{-2} - 9r^4$$



Widening wave guide

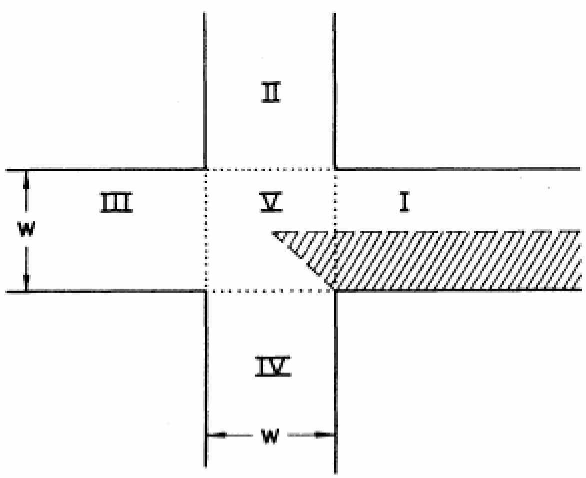


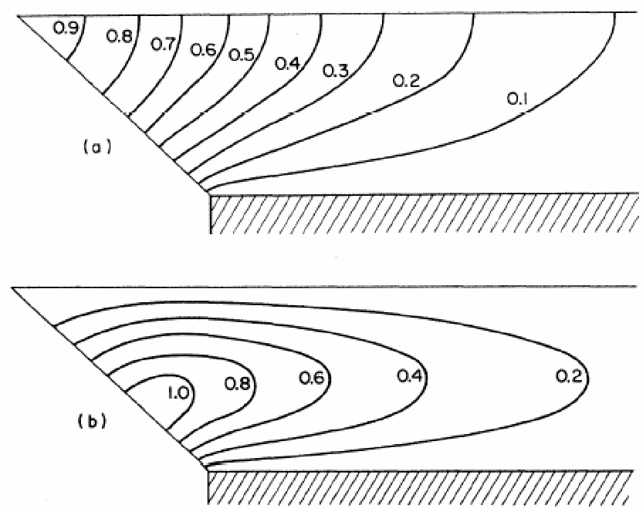
PHYSICAL REVIEW B VOLUME 39, NUMBER 8 15 MARCH 1989-I

Quantum bound states in a classically unbound system of crossed wires

R. L. Schult, D. G. Ravenhall, and H. W. Wyld
Department of Physics, University of Illinois at Urbana-Champaign,
1110 West Green Street, Urbana, Illinois 61801
(Received 17 October 1988)

We have computed the energy and the wave function for an electron caught at the intersection of two narrow channels. There are two bound energies for the case with fourfold rotational symmetry. For impenetrable walls the energies are $E_1=0.66E_t$ and $E_2=3.72E_t$, where the threshold for propagation of electrons in one channel is $E_t=\hbar^2\pi^2/2m^*w^2$ and w is the width of the channel. The state at E_2 is bound only because it has odd parity and thus cannot decay into the even-parity propagating wave at the same energy. (The odd-parity propagation threshold is at $4E_t$.) We have also computed the transmission and reflection probabilities in the propagating case for a range of energies up to slightly above the odd-parity threshold.



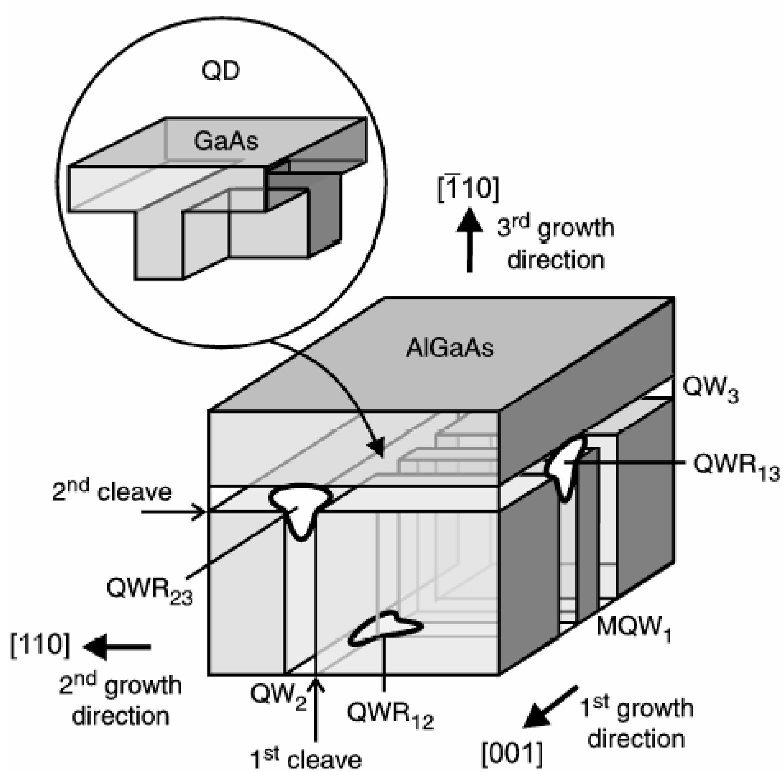


Atomically Precise GaAs/AlGaAs Quantum Dots Fabricated by Twofold Cleaved Edge Overgrowth

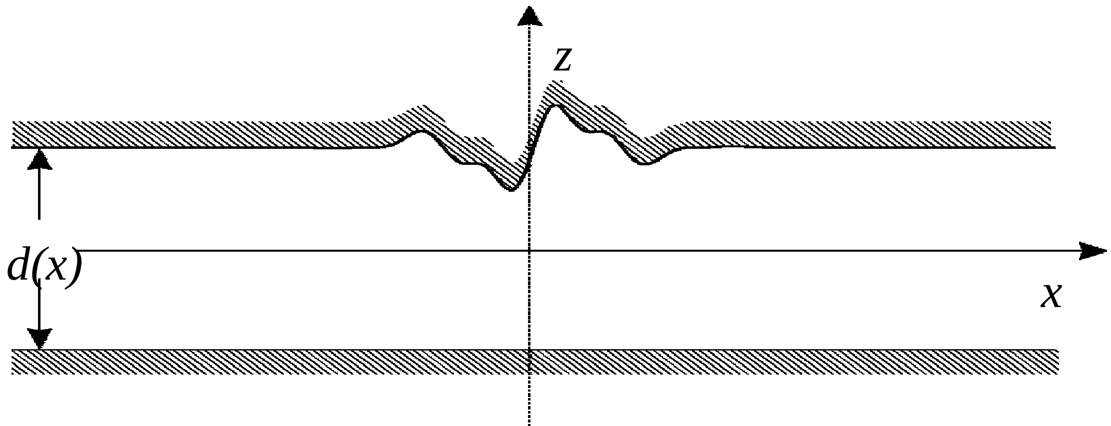
W. Wegscheider, G. Schedelbeck, G. Abstreiter, M. Rother, and M. Bichler

Walter Schottky Institut, Technische Universität München, Am Coulombwall, D-85748 Garching, Germany

(Received 17 March 1997)



Modulated boundary



Unusual Bound or Localized States

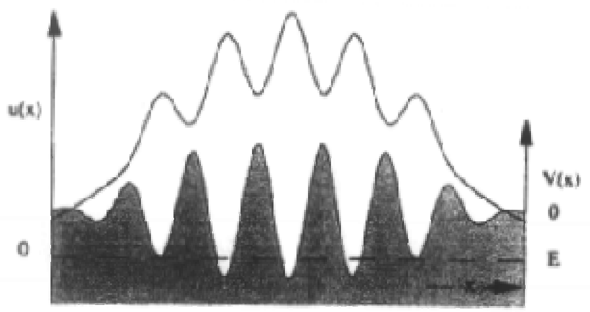
M. A. Cirone[a], G. Metikas[a], and W. P. Schleich[a,b]

[a] Abteilung für Quantenphysik, Universität Ulm, D-89069 Ulm, Germany
[b] Department of Physics, North Texas State University, Denton, TX

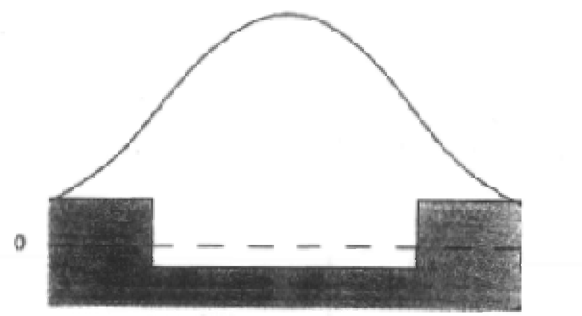
Reprint requests to Dr. M. A. C. E-mail: m_cirone@virgilio.it

Z. Naturforsch. **56 a,** 48–60 (2001); received February 11, 2001

Presented at the 3rd Workshop on Mysteries, Puzzles and Paradoxes in Quantum Mechanics, Gargnano, Italy, September 17 - 23, 2000.



$$\frac{\mathrm{d}^2\varphi(t)}{\mathrm{d}t^2} + [\xi_0 + \xi(t)]\,\varphi(t) = 0$$



$$\frac{\mathrm{d}^2u(x)}{\mathrm{d}x^2} + \frac{2M}{\hbar^2}\,[E - V(x)]\,u(x) = 0$$

Overview

- Formulation of problem
- Scattering of particles with structure
- Potentials from boundary conditions
- Quantum Ulm Sparrow
- Unusual bound states