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HELVETICA PHYSICA ACTA
Zusammenfassungen der letzten eingegangenen Arbeiten
Résumés des derniers articles reçus

Statistical Description of Elementary Processes
II. Quantum Field Theory

by L. P. Horwitz
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(14. II. 72)

Abstract. In a preceding paper, the consequences of the assumption that the measurements set up to characterize the quantum state of certain systems do not form (non-trivially) a complete set was investigated in the framework of the one-particle Hilbert space. In this paper, systems of identical particles, and the structure of the associated quantum fields, are discussed. The general form of the n-body density matrices characterizing incompletely measured states is given, and a special class of observables which 'carry their own incoherence' is constructed. As an illustration, a free charged Klein–Gordon field is constructed; it is shown that the field is non-local if the energy momentum is a non-trivial function of unmeasured variables. Coherent states are discussed, and it is shown that fields with some similarity to those of the Veneziano operator theory appear as a special case in which the spectrum of unmeasured observables corresponds to the four-fold tensor indices of space-time.

On a Recent Paper of Amrein, Georgescu and Jauch

by Colston Chandler
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(14. II. 72)

Abstract. Condition (D) of a recent paper of Amrein, Georgescu and Jauch is shown to be a consequence of their conditions (θ) and (A).

A Note on the Alpha-Decay Half-Lives of Heavy and Superheavy Elements

by M. D. High and R. Malmin
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(17. II. 72)

Abstract. The known alpha-decay half-lives of transuranium elements can be reproduced using an interaction potential having a repulsive core. Results are insensitive to the magnitude of the core height but the derived nuclear half-density radius $= 1.1A^{1/3}$ F. is consistent with those obtained from the analysis of mu-mesic and electron scattering experiments. Using this model and theoretical Q-values from Green's mass formula, the upper limits of alpha-decay half-lives of $(112)^{292,294,296,298,300}$, $(114)^{294,296,298,300,302}$, and $(126)^{310,312,314,316,318}$ are computed. For isotopes of elements 112, our calculations barely overlap with those of Nilsson et al. For isotopes of element 114, our estimated half-lives are considerably shorter than those of Nilsson et al. but agree with those of Grumann et al. For isotopes of 126, our calculated half-lives are longer than those estimated by Muzychka.

On the Uniqueness of the Energy Density in the Infinite Volume Limit for Quantum Field Models

by K. OSTERWALDER and R. SCHRADER

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(25. II. 72)

Abstract. We isolate two properties of the vacuum energy E_V (for volume V) that are sufficient to ensure the existence and uniqueness of $\lim_{V\to\infty} E_V/V$. The first property has been recently verified by Glimm and Jaffe for the $P(\varphi)_2$ quantum field model. The second property is shown to hold in a simplified $P(\varphi)_2$ model where the free field energy H_0 is replaced by the number operator N.

Coherence Resonances in the Alignment-Orientation Coupling Process Induced by an Electric Field

by A. FAIST

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(6. III. 72)

Summary. The alignment-orientation coupling process is studied in the case of atomic excited states in the presence of an electric field. The basic properties are obtained by applying a static electric field. The phenomenon is more complex in the case of an oscillating electric field and new resonances of the coherence type appear. The general properties of these new resonances are studied with the aid of computational methods.

The Chemical Energy Shift of K X-rays

by K. ALDER, G. BAUR and U. RAFF

Institute of Theoretical Physics, University of Basel, Switzerland

(8. III. 72)

Abstract. The chemical energy shift of K X-rays is investigated by means of free ion configurations. The influence of the l-quantum number of the valence electron on $\delta K\alpha$ and $\delta K\beta$ is discussed. A method based on free ion calculations is given for the determination of the ionicity and for the change in total electron density $\delta|\psi(0)|^2$ between two chemical compounds.

Calculation of Internal Conversion Coefficients for all Atomic Shells

by K. ALDER, U. RAFF and G. BAUR

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(8. III. 72)

Abstract. Today extensive calculations of internal conversion coefficients (ICC), including screening and finite nuclear size effects, are available for the K, L, M and N_1 through N_5 atomic shells. In the present paper conversion coefficients for all atomic shells and various nuclear charge numbers, Z, are calculated with Hartree–Fock–Slater bound state wave functions and compared to approximate calculations and to experimental results. The knowledge of theoretical outer shell conversion coefficients offers the possibility of evaluating the change in total electron density $\Delta|\psi(0)|^2$ at the nucleus for isotopes decaying in two different chemical compounds.