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Solvable models in quantum mechanics. (English)

Texts and Monographs in Physics. New York etc.: Springer-Verlag. xiv, 452 p. DM 158.00 (1988).

This monograph presents a detailed and systematic study of models of a particle with δ -function interaction described by the Schrödinger operator with potential supported on a discrete (finite or infinite) set of points. The dimensions d of the space are $d = 1, 2, 3$. These models have been discussed extensively, particularly in solid state physics (e.g. the Kronig-Penney model of a crystal), atomic and nuclear physics (describing short-range nuclear forces or low-energy phenomena) and electromagnetism (propagation in dielectric media).

The main purpose of this monograph is to present the mathematical approaches developed in recent years and to systematize results obtained earlier by different and often heuristic methods in disparate contexts.

Exposition is divided into 3 parts, namely point interactions with one center (Part I), finitely many centers (Part II) and infinitely many centers (Part III). Chapter III.5 of Part III, stochastic potentials are discussed.

The spectrum, the eigenfunctions, resonances, and scattering quantities are explicitly discussed. Convergences of their approximations are also treated.

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Keywords : models of a particle with δ -function interaction; point interactions with one center; finitely many centers; infinitely many centers; stochastic potentials; spectrum; eigenfunctions; resonances; scattering quantities

Classification :

- *46N50 Appl. of functional analysis in quantum physics
- 81-02 Research monographs (quantum theory)
- 81Q05 Closed and approximate solutions to quantum-mechanical equations
- 47A70 Eigenfunction expansions of linear operators
- 35P25 Scattering theory (PDE)
- 81U05 2-body potential scattering theory
- 81Q10 Selfadjoint operator theory in quantum theory
- 81V70 Appl. of quantum theory to many-body systems
- 03H10 Appl. of nonstandard models to other sciences