SEMINARIO

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The behaviour of the three-dimensional Hamiltonian $-\Delta + \lambda[\delta(x + x_0) + \delta(x + x_0)]$ as the distance between the two centres vanishes

Abstract: In this talk I wish to present the latest results of our analysis of the behaviour of self-adjoint Hamiltonians with symmetric double wells given by twin point interactions perturbing various types of "free Hamiltonians" as the distance between the two centres shrinks to zero. In particular, by making the coupling constant to be renormalised dependent also on the separation distance between the two impurities, we prove that it is possible to rigorously define the unique self-adjoint Hamiltonian that, differently from the one studied in detail in [1], behaves smoothly when such a limit is performed. In fact, we rigorously prove that the new Hamiltonian introduced in this note converges in the norm resolvent sense to the one of the negative three-dimensional Laplacian perturbed by a single attractive point interaction situated at the origin having double strength, thus making this three-dimensional model more similar to its one-dimensional analogue (not requiring the renormalisation procedure) as well as to the three-dimensional model involving impurities given by potentials whose range may even be physically very short but different from zero.

Joint work with Sergio Albeverio and Fabio Rinaldi.

[1] Albeverio S, Gesztesy F, Høegh-Krohn R and Holden H (2004) Solvable models in Quantum Mechanics AMS (Chelsea Series) second edition (with an appendix by P. Exner)

Seminario B118, Facultad de Ciencias
3 de Febrero de 2017 (12:00)
Organiza: G.I.R. Física Matemática