

Atoms in a thin layer

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A hydrogen-like atom in a plane-parallel slab is considered. The energy spectrum of such atom is investigated as the width of the slab a tends to zero. It turns out that it is well approximated by the spectrum of a two-dimensional Hamiltonian that we call the effective Hamiltonian. The spectrum of the effective Hamiltonian can be still barely found by analytic methods. Nevertheless, it may be proved that the norm resolvent limit of the effective Hamiltonian as $a \rightarrow 0$ is nothing but the two-dimensional hydrogenic Hamiltonian. The latter model is exactly solvable. Consequently, one may use the exact knowledge of the eigenvalues of the two-dimensional hydrogenic Hamiltonian to approximate the eigenvalues of the initial Hamiltonian. The talk is based on a joint work with P. Duclos and P. Stovicek.