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On semiclassical eigenvalue distribution theorems for perturbations of the Landau Problem

Let $H_0 = (-\imath\frac{\partial}{\partial x} + \frac{B}{2}y)^2 + (-\imath\frac{\partial}{\partial y} - \frac{B}{2}x)^2$ be the Landau Hamiltonian with spectrum given by the infinitely degenerate discrete Landau levels $\lambda_n = B(2n+1)$, with B the strength of the constant magnetic field and n a non-negative integer number. We consider perturbations given by smooth short range electric potentials V. We study two semiclassical limits of the eigenvalue distribution inside the clusters around the Landau levels generated by the perturbation. In the first one, we study the high energy limit $n \to \infty$ of the clusters associated to the operator $H = H_0 + V$ around λ_n. In the second one, we introduce the Planck parameter $\hbar$ achieving only discrete values $\hbar = E/(2n+1)$ and actually consider the unperturbed operator $\tilde{H}_0 = (-\imath\hbar\frac{\partial}{\partial x} + y)^2 + (-\imath\hbar\frac{\partial}{\partial y} - x)^2$ taking $B = 2/\hbar$. Considering the perturbation $\hbar^2 V$, we study the limit $n \to \infty$ fixing the classical energy E and looking at the eigenvalue clusters of $\tilde{H} = \tilde{H}_0 + \hbar^2 V$ around E. We obtain averages of V along straight lines on the plane and along circles on the plane with arbitrary center and fixed radius (the classical orbits with energy E) in the first and second limits respectively. This is joint work with A. Pushnitski, G Raikov, G. Hernandez Dueñas, S. Perez-Esteva and A. Uribe.