Analytic Structure of Many-Body Coulombic Wave Functions

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We investigate the analytic structure of solutions of non-relativistic Schrödinger equations describing Coulombic many-particle systems. We prove the following: Let $\psi(\mathbf{x})$ with $\mathbf{x} = (x_1, \cdots, x_N) \in \mathbb{R}^{3N}$ denote an N-electron wavefunction of such a system with one nucleus fixed at the origin. Then in a neighbourhood of a coalescence point, for which $x_1 = 0$ and the other electron coordinates do not coincide, and differ from 0, ψ can be represented locally as $\psi(\mathbf{x}) = \psi^{(1)}(\mathbf{x}) + |x_1|\psi^{(2)}(\mathbf{x})$ with $\psi^{(1)}$, $\psi^{(2)}$ real analytic. A similar representation holds near two-electron coalescence points. The Kustaanheimo-Stiefel transform and analytic hypoellipticity play an essential role in the proof.