Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Resolving the Laughlin Paradox TALBOT CHUBB, Physicist Consultant, 5023 N. 38th St., Arlington, VA 22207 — For paired Bloch electrons in a metal not subject to Pauli exclusion, the 2-electron Hamiltonian has the form

$$H = \frac{-\hbar^2}{4m_e}\Delta_{cm} + (2e)U_{lattice}(r_{cm}, N_{cell}) + \frac{e^2}{(N_{cell} r_{12})} - \frac{\hbar^2}{3m_e}\Delta_{12},$$

where $r_{cm} = r_1 + r_2, r_{12} = r_1 - r_2$, and r_1 and r_2 are position vectors in configuration space, involving independent Bravais vectors R_1 and R_2 , such that $R_1 - R_2 = R_{12}$ is an independent Bravais lattice vector, and N_{cell} is the number of mutually shared potential wells over which the 2 electrons are coherently partitioned with entangled local density maxima. At large N_{cell}, the magnitude of term 3 << the magnitude of term 1. When coordinate exchange symmetry is satisfied and energy minimized, term 3 cancels term 1 at $r_{12} = 0$, eliminating the singularity in the wave equation, thereby resolving Laughlin's paradox[1]

[1]R.B. Laughlin, "A Different Universe", (Basic Books, Cambridge MA, 2005) pp. 84-85.

Scott Chubb
Naval Research Laboratory

Date submitted: 05 Dec 2005