1016-33-181 **Frank E Harris*** (`harris@qtp.ufl.edu`), Quantum Theory Project, University of Florida, P.O. Box 118435, Gainesville, FL 32611-8435. *Dilogarithms and four-body atomic Coulomb interaction integrals for fully correlated exponential wavefunctions.*

We consider integrals of the form

$$I = \int d\mathbf{r}_1 d\mathbf{r}_2 d\mathbf{r}_3 \frac{\exp(-\alpha_1 r_1 - \alpha_2 r_2 - \alpha_3 r_3 - \alpha_{12} r_{12} - \alpha_{13} r_{13} - \alpha_{23} r_{23})}{r_1 r_2 r_3 r_{12} r_{13} r_{23}},$$

where the integration of each $\mathbf{r}_i$ is over $\mathcal{R}^3$, $r_i = |\mathbf{r}_i|$, $r_{ij} = |\mathbf{r}_i - \mathbf{r}_j|$, and the $\{\alpha\}$ have values such that the integral converges. In 1987 Fromm and Hill obtained a closed form for this integral; it involved 19 dilogarithm functions, each with a complicated argument, and with the disturbing features that (1) it is difficult to determine the branch on which each dilogarithm is to be evaluated, and (2) individual dilogarithms had singularities at $\{\alpha\}$ values in the interior of the convergence region of I. A few years later, Remiddi obtained a far simpler formula for the special case $\alpha_{12} = \alpha_{13} = \alpha_{23} = 0$, but a proof that these formulas were consistent remained elusive. We present a new dilogarithm identity permitting reconciliation of these formulas, and also describe procedures for branch identification and singularity cancellation. (Received February 11, 2006)