Abstract Submitted
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**A quantum liquid with deconfined fractional excitations in three dimensions** NIC SHANNON, OLGA SIKORA, University of Bristol, FRANK POLLMANN, UC-Berkeley, KARLO PENC, SZFKI Budapest, PETER FULDE, MPI-PKS Dresden — Excitations which carry "fractional" quantum numbers are known to exist in one dimension in polyacetylene, and in two dimensions, in the fractional quantum Hall effect. Fractional excitations have also been invoked to explain the breakdown of the conventional theory of metals in a wide range of three-dimensional materials. However the existence of fractional excitations in three dimensions remains highly controversial. Here we report direct numerical evidence for the existence of an extended quantum liquid phase supporting fractional excitations in a concrete, three-dimensional microscopic model — the quantum dimer model on a diamond lattice [1]. We demonstrate explicitly that the energy cost of separating fractional monomer excitations vanishes in this liquid phase, and that its energy spectrum matches that of the Coulomb phase in $(3+1)$ dimensional quantum electrodynamics [2,3].

[1] O. Sikora *et al.* arXiv:0901.1057v3 — to appear in Phys. Rev. Lett.
[2] R. Moessner and S.L. Sondhi, Phys. Rev. B **68**, 184512 (2003).
[3] D.L. Bergman *et al.* Phys. Rev. B **73**, 134402 (2006).

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