Abstract Submitted for the MAR14 Meeting of The American Physical Society

Ferromagnetic ordering in an insulator by itinerant electrons¹ J.N.B. RODRIGUES, Graphene Research Centre and Physics Department of the Faculty of Science of the National University of Singapore, AIGU L. LIN, Graphene Research Centre, NUS Graduate School of Integrative, and Physics Department of the Faculty of Science of the National University of Singapore, A.H. CASTRO NETO, Graphene Research Centre and Physics Department of the Faculty of Science of the National University of Singapore, S. ADAM, Graphene Research Centre, Physics Department of the Faculty of Science of the National University of Singapore, and Yale-NUS College, ANDREW T.S. WEE, Graphene Research Centre, NUS Graduate School of Integrative, and Physics Department of the Faculty of Science of the National University of Singapore — Motivated by recent experimental work of variable range hopping of electrons between magnetic nanoparticles in oxidized graphene, we consider theoretically an ensemble of randomly oriented classical Heisenberg magnetic moments which are superparamagnetic at room temperature and have negligible magnetostatic coupling. Itinerant electrons hopping through random sites experience a Zeeman coupling with these moments. Using Monte Carlo simulations, we demonstrate that this generates an effective electron-mediated coupling between the Heisenberg moments giving rise to spontaneous magnetization of the sample. We make predictions for the temperature dependence of this magnetization and compare with experimental data.

¹We thank the financial support from Singapore NRF-CRP award R-144-000-295-281, from Singapore NRF Fellowship award R-144-000-302-281, and from the Singapore MOE ARF Grant No. R-398-000-056-112.

J. N. B. Rodrigues Graphene Research Centre and Physics Department of the Faculty of Science of the National University of Singapore

Date submitted: 12 Nov 2013

Electronic form version 1.4