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Theory of Berry Phases in the Cuprate Pseudogap Phase GEREMIA MASSARELLI, TAMAR PEREG-BARNEA, McGill University — The geometric Berry phase is part of the phase accumulated by a quantum system undergoing adiabatic evolution around a closed loop in parameter space [1]. Recently, data from quantum oscillations experiments, in which Berry's phase is accessible via its contribution to the phase offset, were used to determine Berry's phase in certain electron- and hole-doped cuprate superconductors in high-magnetic-field regimes [2]. The data reveal a trivial Berry phase of 0 in the hole-doped materials examined, while a phase of $\sim 1.4\pi$ was found in the electron-doped material. These findings set new, significant constraints on the possible descrpitions of the pseudogap phase of the cuprates. This is used as a test of validity for some proposed models of cuprate superconductors. Berry's phase is computed within the framework of these models in high-field regimes and compared to the experimental findings.

[1]Berry, M. V. Quantal Phase Factors Accompanying Adiabatic Changes. *Proceedings of the Royal Society of London. A. Mathematical and Physical Sciences* **392**, 45-57 (1984).
[2]Doiron-Leyraud, N., et al. Berry Phase in Cuprate Superconductors. *arXiv preprint arXiv:1407.1388* (2014).

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