

Isosbestic Points: Fingerprints of Electronic Correlations

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A family of non-monotonic curves, obtained by plotting a quantity $f(x, y)$ as a function of one of its variables (say, x) for different values of y , will in general intersect, leading to crossing points of the curves. In physics, chemistry and biology the crossing of a family of curves is the rule rather than the exception. Sometimes these crossing points are found to be confined to a remarkably narrow region, or are even located at a single point [1], thus leading to a conspicuous feature often called *isosbestic point* [2,3]. For example, crossing points are observed in the curves of the specific heat $C(T, P)$ vs. temperature T of normal fluid ^3He [4] and are reproduced within a phenomenological model of this phase in terms of the Gutzwiller approximation [5]. More recently, sharp crossing points have been found in the optical conductivity $\sigma(\omega, n)$ of the Falicov-Kimball model [7] as well as in measurements of the photoemission spectrum $A(\omega, T)$ [8], the reflectivity $R(\omega, T)$ [9], and the Raman response $\chi''(\omega, T)$ [10] of transition metal oxides. I will show that isosbestic points always provide valuable information about the system in which they occur [3,6,11].

- [1] G. Scheibe; *Angew. Chemie* **50**, 212 (1937).
- [2] M. D. Cohen and E. Fischer; *J. Chem. Soc.* **2**, 3044 (1962).
- [3] M. Eckstein, M. Kollar, and D. Vollhardt; *J. Low Temp. Phys.* **147**, 279 (2007)
- [4] D. Greywall; *Phys. Rev. B* **27**, 2747 (1983).
- [5] K. Seiler, C. Gros, T.M. Rice, K. Ueda and D. Vollhardt; *J. Low Temp. Phys.* **64**, 195 (1986).
- [6] D. Vollhardt; *Phys. Rev. Lett.* **78**, 1307 (1997).
- [7] J. Freericks and V. Zlatic; *Rev. Mod. Phys.* **75** 1333 (2003).
- [8] K. Okazaki, H. Wadati, A. Fujimori, M. Onoda, Y. Muraoka, and Z. Hiroi; *Phys. Rev. B* **69**, 165104 (2004).
- [9] C. Kant, T. Rudolf, F. Mayr, S. Krohns, P. Lunkenheimer, S. Ebbinghaus, and A. Loidl; *Phys. Rev. B* **77**, 45131 (2008).
- [10] W. Guyard, M. Le Tacon, M. Cazayous, A. Sacuto, A. Georges, D. Colson, and A. Forget; *Phys. Rev. B* **77**, 24524 (2008).
- [11] M. Greger, M. Kollar, and D. Vollhardt; to be published.