

# Phonon-assisted electron hopping conduction in the uranium doped one-dimensional antiferromagnet $\text{Ca}_2\text{CuO}_3$

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**Abstract:** The authors studied the conduction mechanism in an uranium doped low dimensional magnetic system  $\text{Ca}_2\text{CuO}_3$ . This system exhibits the  $S=1/2$  quasi 1D antiferromagnetic chains of  $-\text{Cu}-\text{O}-$  with strong magnetic coupling, and demonstrates continuous semiconductor-like behavior with constant covalent insulator character. This paper identifies the conduction is due to thermally activated phonon-assisted electron hopping between dopant uranium sites. The parameter  $\alpha$ , the characteristic for hopping probability, was determined to be  $0.18 \text{ \AA}^{-1}$ . This value manifests a relatively stronger hopping probability for  $\text{Ca}_2\text{CuO}_3$  as compared with other uranium doped ceramics. © 2008 Journal of Magnetism.

**Author Keywords:** Antiferromagnet; Conduction; Phonon-assisted; Uranium

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References:

- S. B. Stringfellow, S. Gupta, C. Shaw, J. R. Alcock, and R. W. Whatmore, J. of the Eur. Cer. Soc. 22, 573 (2002)R. Weinstein, US Patent 6083 885 (2000) and R. Weinstein, and R. P. Sawh, Supercond. Sci. Technol. 15, 1474 (2002)Hari Babu, N., Kambara, M., Shi, Y., Cardwell, D.A., Tarrant, C.D., Schneider, K.R., (2003) IEEE Trans. on Appl. Supercond, 13, p. 3147
- Eder, M., Gritzner, G., (2000) Supercond. Sci. Technol, 13, p. 1302

- D. C. Huynh, D. T. Ngo, and N. N. Hoang, *J. of Phys: Cond. Matters* 19, 106215 (2007) Hoang, N.N., Huynh, D.C., Nguyen, T.T., Ngo, D.T., Nguyen, D.T., Fennie, A., Chau, N., (2008) *Applied Phys. A*, 92, pp. 715-725. , DOI: 10.1007/s00339-008-4631-y
- Yamada, K., Wada, J., Hosoya, S., Endoh, Y., Noguchi, S., Kawamata, S., Okuda, K., (1995) *Physica C*, 253, p. 135
- Gaussian 03, Revision B.03, M. J. Frisch, G. W. Trucks, H. B. Schlegel, G. E. Scuseria, M. A. Robb, J. R. Cheeseman, J. A. Montgomery, Jr, T. Vreven, K. N. Kudin, J. C. Burant, J. M. Millam, S. S. Iyengar, J. Tomasi, V. Barone, B. Mennucci, M. Cossi, G. Scalmani, N. Rega, G. A. Petersson, H. Nakatsuji, M. Hada, M. Ehara, K. Toyota, R. Fukuda, J. Hasegawa, M. Ishida, T. Nakajima, Y. Honda, O. Kitao, H. Nakai, M. Klene, X. Li, J. E. Knox, H. P. Hratchian, J. B. Cross, C. Adamo, J. Jaramillo, R. Gomperts, R. E. Stratmann, O. Yazyev, A. J. Austin, R. Cammi, C. Pomelli, J. W. Ochterski, P. Y. Ayala, K. Morokuma, G. A. Voth, P. Salvador, J. J. Dannenberg, V. G. Zakrzewski, S. Dapprich, A. D. Daniels, M. C. Strain, O. Farkas, D. K. Malick, A. D. Rabuck, K. Raghavachari, J. B. Foresman, J. V Ortiz, Q. Cui, A. G Baboul, S. Clifford, J. Cioslowski, B. B. Stefanov, G. Liu, A. Liashenko, P. Piskorz, I. Komaromi, R. L. Martin, D. J. Fox, T. Keith, M. A. Al-Laham, C. Y. Peng, A. Nanayakkara, M. Chai, V. Chaudhary, G. P. Hratchian, A. L. Myhre, B. G. Pempber, J. I. Schmales, T. L. Schmitz, D. G. Desfrancis, J. D. Chabaloy, W. G. Shields, M. J. Ochterski, J. P. Poirer, (2003) *Journal of Applied Physics*, 94 (8), p. 4964
- Hoang, N.N., Huynh, D.C., Phan, M.H., (2006) *Solid State Commun*, 139, p. 456
- Maiti, K., Sarma, D.D., Mizokawa, T., Fujimori, A., (1998) *Phys. Rev. B*, 57, p. 1572
- Lines, D.R., Weller, M.T., Currie, D.B., Ogborne, D.M., (1991) *Mater. Res. Bull*, 26, p. 323
- Hoang, N.N., Nguyen, T.H., Chau, N., (2008) *J. Appl. Phys*, 103, p. 093524