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ARPES matrix element and the waterfall effect in the cuprates.

SUSMITA BASAK, TANMOY DAS, Northeastern U., JOUKO NIEMINEN, MATTI LINDROOS, Tampere U. Tech., Finland and Northeastern U., HSIN LIN, ROBERT MARKIEWICZ, ARUN BANSIL, Northeastern U. — The high-energy kink (HEK) or the 'waterfall' effect as seen in angle-resolved photoemission spectra (ARPES) in the cuprates has the potential of revealing important information about the dressing of quasiparticles by electronic excitations [1,2,3]. However, recently it has been suggested that matrix element effects radically modify the experimental spectra in $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_8$ (Bi2212), and it has been questioned whether the HEK exists [4]. Here we discuss how the interplay between the matrix element and self-energy effects shapes the ARPES spectra. Both the ARPES matrix element and the self-energy are found to be necessary for understanding the experimental spectra. Work supported in part by the USDOE. [1] R. S. Markiewicz *et al.*, Phys. Rev. B **76**, 174514 (2007). [2] A. Macridin *et al.*, Phys. Rev. Lett. **99**, 237001 (2007). [3] Tanmoy Das *et al.*, cond-mat:0807.4257. [4] D.S. Inosov *et al.*, Phys. Rev. Lett. **99**, 237002 (2007).

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