Critical exponents of the three-dimensional Anderson transition from multifractal analysis

Alberto Rodriguez,1, ¤ Louella J. Vasquez,1 Keith Slevin,2 and Rudolf A. R¨omer1

1Department of Physics and Centre for Scientific Computing, University of Warwick, Coventry, CV4 7AL, United Kingdom 2Department of Physics, Graduate School of Science, Osaka University, 1-1 Machikaneyama, Toyonaka, Osaka 560-043, Japan

We use high-precision, large system-size wave function data to analyse the scaling properties of the multifractal spectra around the disorder-induced three-dimensional Anderson transition in order to extract the critical exponent ν of the localisation length. We study the scaling law around the critical point of the generalized inverse participation ratios $P_q = \langle |\Psi_i|^2 \rangle$ and the singularity exponent α_0, defined as the position of the maximum of the multifractal spectra, as functions of the degree of disorder W, the system size L and the box-size l used to coarse-grained the wave function amplitudes. The values of α_0 are calculated using a new method entirely based on the statistics of the wave function intensities (*Phys. Rev. Lett. 102, 106406 (2009)*). Using finite size scaling analysis we find agreement with the values of ν obtained from transfer matrix calculations.