Critical exponent of MIT at various dimensions and Quantum percolation at conduction band center

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The metal - insulator transition (MIT) induced by disorder is studied numerically for the Anderson model and the Quantum site Percolation (QsP) model. The correlation legth's critical exponent ν, calculated elsewhere [1] as a function of dimension d is shown to be rather far from available theoretical predictions. Only the mean-field value $\nu = 1/2$ seems to be indisputable. Even the prefactor of $1/(d-2)$ term, predicted by Wegner [2], is different from our Padè-approximation of numerical data.

The analysis of MIT is based on single parameter scaling (SPS) hypothesis. This is perfectly valid for the Anderson model, but the SPS holds for 3D QsP only outside the puzzling region at conduction band center $E = 0$, where E is the energy of charge careers. We get non-universality close to band center [3], i. e. if we insist on SPS, the ν is only around 1.0 for 3D QsP, but it is widely accepted to be $\nu = 1.57$ for 3D Anderson model. If these are only finite-size effects, then they are unusually huge. Further differences arise between arithmetically and geometrically averaged conductances, changing the shape of mobility edge (MIT line), again at the problematic band center. The reason is a small ratio of samples with strictly zero conductance, pushing the geometric mean also to zero, but leaving the arithmetic mean finite.

[1] P. Markoš, Acta Phys. Slovaca **56**, 561 (2006).
[2] F. Wegner, Nucl. Phys. B **316**, 663 (1989).
[3] I. Travěnec, arXiv: 0712.0449v1, (2007).