Heterogeneity-Induced Non-Fickian Transport: Long Correlations versus Broad Disorder Distributions

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We identify long disorder correlations on one hand and broad heterogeneity distributions on the other hand as causes for anomalous transport patterns with different impact on the effective transport behavior. We derive exact effective transport equations for two scenarios starting from microscale transport descriptions for two heterogeneity scenarios: (i) strong disorder correlation and narrow disorder distribution, and (ii) weak correlation and broad disorder distribution. We discuss the resulting effective behaviors and the differences between them in terms of large scale spatial distributions and breakthrough curves. Using these results we derive criteria how to distinguish between such "heterogeneity-induced" and "distribution-induced" anomalous transport patterns.