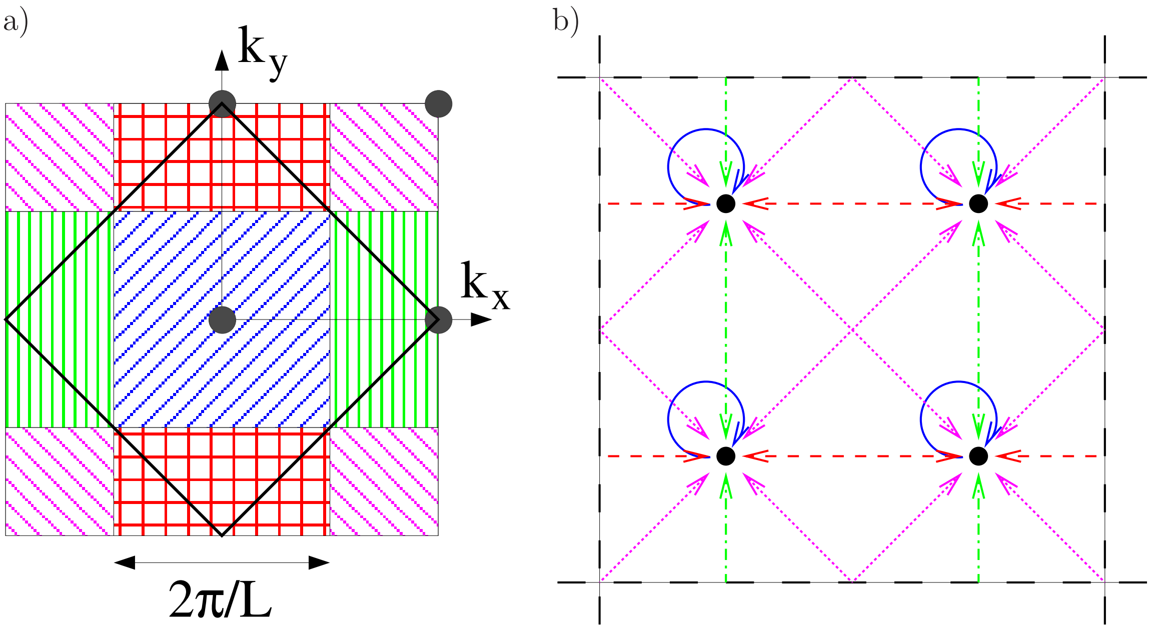

Figure A.3: DCA. **a)** Illustration of course-graining of the Brillouin zone for $d = 2$ and $L = 2$ [taken from Hettler et al. (2000)]. **b)** Real-space scheme of the resulting impurity model. Each impurity is not only influenced by a local bath (a frequency-dependent on-site energy), but also coupled by frequency-dependent hopping matrix elements to other impurities (arrows). The couplings also extend across the periodic cluster boundaries.

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assumed to depend only on the coarse-grained momentum which may be chosen as $K_{\alpha l} = 2\pi l/L$, where $0 \leq l < L$ and $1 \leq \alpha \leq d$ labels the dimensions. This is illustrated in Fig. A.3a for $d = 2$ and $L = 2$ where the Brillouin zone is mapped onto $L^2 = 4$ coarse-grained momenta. Given a self-energy with constant functional form (with respect to ω) on each of the patches one may apply the obvious generalization of (1.30) for computing a coarse-grained lattice Green function which in turn defines a generalized bath Green function by using (1.35) for each K. The corresponding generalized real-space impurity problem, illustrated in Fig. A.3b now involves L^d impurities which do not only couple to frequency-dependent baths (which here appear as generalized on-site energies), but are also coupled by generalized hopping processes with frequency-dependent amplitudes. This problem has to be solved in presence of on-site interactions on each impurity in order to calculate a new Green function for the periodic cluster which is then interpreted as a course-grained lattice Green function so that the iteration scheme can be closed. The method evidently reduces to the DMFT for $L = 1$, but involves the solution of a problem even more complicated than a periodic finite-size Hubbard model in the general case. It can be shown to be causal at any L and to approach the exact finite-dimensional model for $L \to \infty$; therefore it constitutes a very attractive interpolating scheme between finite and infinite dimensions.

The distinctive feature of CDMFT methods (Lichtenstein and Katsnelson, 2000; Kotliar, Savrasov, and Pálsson, 2001) (where "C" stands for "cluster" or "cellular")