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# Tzu-Chieh Wei: Kennedy-Tasaki transformation and non-invertible symmetry in lattice models beyond one dimension

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Symmetry-protected topological phases are dual to spontaneous symmetry-breaking phases, recognized by Kennedy and Tasaki using a non-local transformation (i.e., KT transformation). On the symmetry-breaking side, Kramers-Wannier duality transformation was long known to map between ordered phase (i.e., symmetry-breaking phase) and symmetry-preserving phase (i.e., disordered phase). There has been progress in KT and KW duality, especially for one spatial quantum systems. Here, we give an explicit operator representation, via a sequential circuit and projection to symmetry subspaces (hence noninvertible operations), of Kramers-Wannier duality transformation in higher-dimensional subsystem symmetric models, generalizing the construction in the 1D transverse-field Ising model. Combining such a Kramers-Wannier duality operator, we also construct the Kennedy-Tasaki transformation that maps subsystem symmetry-protected topological phases to spontaneous subsystem symmetry-breaking phases, where the symmetry for the former is either Z_2 or Z_2xZ_2. This also generalizes the recently proposed picture of the one-dimensional Kennedy-Tasaki transformation as a composition of manipulations involving gauging and stacking symmetry-protected topological phases to higher dimensions. Additionally, there has been progress in characterizing certain non-invertible symmetry protected phases in (1+1)d and we also present some results of high-order topological phases protected by a combination of non-invertible and subsystem symmetry. For example, there can be gapless modes residing on the corners of the boundary between two distinct non-invertible symmetry-protected phases, instead of the entire boundary. What combinations of non-invertible and invertible symmetries are anomalous (and hence what non-invertible symmetry-protected phases are not allowed) can be understood using fusion of symmetry defects.