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Simple examples of Symmetry-Protected Topological phases and Symmetry-Enriched Topological phases of quantum lines OLEXEI MOTRUNICH, SCOTT GERAEDTS, California Institute of Technology — We construct models realizing distinct confining phases of lattice gauge theories envisioned in a formal classification of gapped phases of gauge theories by Kapustin and Thorngreen, arXiv:1309.4721. This generalizes ideas of Symmetry-Protected Topological (SPT) phases in Condensed Matter to systems where fundamental microscopic objects are quantum lines, which is of interest in High Energy Theory. Specifically, in (3+1)D, we consider discrete Z_N lattice gauge theory models, with two copies of Z_N, and construct N distinct confining phases by engineering condensation of bound states of magnetic fluxes (which are quantum lines in 3d) and Z_N electric field lines. In (4+1)D, we consider compact quantum electrodynamics (CQED) models, with two copies of CQED, and engineer condensation of bound states of monopoles (which are quantum lines in 4d) and U(1) electric field lines. When the bound states contain a single monopole, we find SPT-like phases of the lattice gauge theory, while when the bound states contain multiple monopoles, we find analogs of Symmetry-Enriched Topological phases, where in the present case we also have fractionalization of Faraday lines. The distinct character of these topological phases of quantum lines is revealed by unusual physics at a boundary.

Olexei Motrunich
California Institute of Technology

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