Superconducting circuits have emerged as a competitive platform for quantum computation, satisfying the challenges of controllability, long coherence and strong interactions. I will show our recent experiments to apply this toolbox to the exploration of strongly correlated quantum materials made of microwave photons. We develop a new approach for preparing photonic many-body phases, where engineered dissipation is used as a resource to protect the fragile quantum states against intrinsic losses. We apply it to our system, a strongly interacting Bose-Hubbard lattice, and realize a dissipatively stabilized Mott insulator of photons. The dynamics of thermalization towards the Mott phase is probed using lattice-site- and time-resolved microscopy. In a separate experiment, we build Chern insulator lattices for microwave photons and observe topologically protected edge states. Our experiments demonstrate superconducting circuits as a powerful platform for studying synthetic quantum materials, and I will briefly discuss our future directions: e.g. the exploration of strongly interacting topological phases, entanglement and quantum thermodynamics in driven-dissipative settings.