Computational models of physical systems should take into account the manner in which systems handle energy flux and more broadly, underlying conservation laws. This can be a significant challenge when models are derived directly from system response data; observational noise can further complicate the enterprise.

I will discuss modeling frameworks that account for energy conservation and dissipation for dynamical systems and in particular, allow one to ascertain whether an observed response profile is compatible with a particular dissipation/conservation model. This leads naturally to a data-driven modeling framework that has features in common with classic Nevanlinna-Pick interpolation and port-Hamiltonian modeling. This analysis framework results in a convex parametric family of dissipative models all of which are consistent with observed response profiles and well-suited for further optimization with respect to usual design and control metrics.