Generalizing speed-of-light limitations to arbitrary passive linear media AARON WELTERS, STEVEN JOHNSON, Department of Mathematics, Massachusetts Institute of Technology — We prove that well-known speed of light restrictions on electromagnetic energy velocity can be extended to a new level of generality, encompassing even nonlocal chiral media in periodic geometries, while at the same time weakening the underlying assumptions to only passivity and linearity of the medium (along with a transparency window, which ensures well-defined energy propagation). Surprisingly, passivity alone is sufficient to guarantee causality and positivity of the energy density (with no thermodynamic assumptions), in contrast to prior work which typically assumed the latter properties. Moreover, our proof is general enough to include a very broad range of material properties, including anisotropy, bianisotropy (chirality), nonlocality, dispersion, periodicity, and even delta functions or similar generalized functions. The results in this talk are proved using deep results from linear-response theory, harmonic analysis, and functional analysis.

Aaron Welters
Department of Mathematics, Massachusetts Institute of Technology