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Positive Energy Conditions in 4D Conformal Field Theory KARA FARNSWORTH, MARKUS LUTY, VALENTINA PRILEPINA, Univ of California - Davis — We argue that all consistent 4D quantum field theories obey a spacetime-averaged weak energy inequality $T^{00} \geq -C/L^4$, where L is the size of the smearing region, and C is a positive constant that depends on the theory. If this condition is violated, the theory has states that are indistinguishable from states of negative total energy by any local measurement, and we expect instabilities or other inconsistencies. We apply this condition to 4D conformal field theories, and find that it places constraints on the OPE coefficients of the theory. The constraints we find are weaker than the "conformal collider" constraints of Hofman and Maldacena. We speculate that there may be theories that violate the Hofman-Maldacena bounds, but satisfy our bounds. In 3D CFTs, the only constraint we find is equivalent to the positivity of 2-point function of the energy-momentum tensor, which follows from unitarity. Our calculations are performed using momentum-space Wightman functions, which are remarkably simple functions of momenta, and may be of interest in their own right.

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