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Michael T. Lacey (Lacey@math.gatech.edu), School of Mathematics, Georgia Institute of Technology, Atlanta, GA 30332, **Eric T. Sawyer** (sawyer@mcmaster.ca), Department of Mathematics and Statistics, McMaster University, 1280 Main Street West, Hamilton, Ontario L8S 4K1, Canada, and **Ignacio Uriarte-Tuero*** (uriarte@math.msu.edu), Department of Mathematics, Michigan State University, East Lansing, MI 48824. *A characterization of the two weight norm inequality for the Hilbert transform.*

The two weight inequality for the Hilbert transform for locally finite Borel measures with no point masses in common is characterized in terms of (1) a Poisson A_2 condition on the weights (2) A forward testing condition, in which the two weight inequality is tested on intervals (3) and a backwards testing condition, dual to (2). A critical new concept in the proof is an Energy Condition, which incorporates information about the distribution of the weights in question inside intervals. This condition is a consequence of the three conditions above. The notion of Energy also provides a decisive improvement of a standard 'off-diagonal' estimate on singular integrals, used in the sufficient direction. This new concept is combined with a known proof strategy devised by Nazarov-Treil-Volberg. A counterexample shows that the energy condition must be used in the characterization. (Received January 25, 2010)