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Shock Invariants and Conservation Laws in (1+1) Dimensions ROGER MINICH, DANIEL ORLIKOWSKI, GEORGE LEVESQUE, LLNL — The origin of scaling laws in shocked condensed matter provides clues concerning energy and momentum transport connecting the unshocked state to the stationary shocked state. One notable scaling law relating the shock rise time to the peak shock pressure ("Fourth Power Law" (D. Grady) is observed in a wide range of homogeneous materials and for a wide range of pressures. This scaling law may be more fundamentally related to a shock invariant quantity defined by the product of the energy dissipated per unit mass and the duration over which the energy is dissipated. We show that using the energy-momentum tensor, commonly used in physics to describe symmetries and conservation laws, can be used to constrain the transport and corresponding shock structure in 2 dimensions (1 space+1 time). The empirical scaling laws mentioned above follow as a natural consequence of the known conservation laws. The implications are far reaching and this may be the first non-perturbative calculation of shock entropy in a strong shock. This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344 Lawrence Livermore National Security, LLC.

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