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New approach to magnetohydrodynamic shocks: duality under time reversal HANS GOEDBLOED, FOM-INstitute for Plasma Physics — The traditional theory of MHD shocks starts from jump conditions obtained by integrating the nonlinear evolution equations through the discontinuity, then eliminates jumps that do not correspond to entropy increase across the shock, and finally eliminates the intermediate shocks because of supposed non- evolutionarity. Since intermediate shocks do occur in nature and computations (the only dispute is on the time-scale of disintegration) and entropy-decreasing discontinuities may be considered as reverse shocks (with upstream and downstream parameters interchanged), these restrictions are not necessary and hamper understanding of the nonlinear structure of the shock conditions. When the restrictions are dropped, the MHD shock conditions may be reduced to their most concise, three- parameter, distilled form by consistent use of the de Hoffmann- Teller transformation (1950) and of scale independence of the MHD equations (Goedbloed & Poedts, 2004). They then exhibit distinct time reversal duality between entropy-allowed shocks and entropy-forbidden jumps. This yields a new classification of MHD shocks using monotonicity with respect to Alfvén Mach numbers, it exhibits the central role of intermediate discontinuities, and permits straightforward construction of all relevant dimensionless quantities of the shocks. The new conditions may easily be incorporated into large-scale nonlinear computations.

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