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**Plane shock waves and Haff's law in a granular gas** LAKSHMINARAYANA REDDY, MEHEBOOB ALAM, Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur PO, Bangalore 560064 — The Riemann problem of planar shock waves is analyzed for a dilute granular gas by solving Euler- and Navier-Stokes-order equations numerically. The density and temperature profiles are found to be asymmetric, with the maxima of both density and temperature occurring within the shock-layer. The density-peak increases with increasing Mach number and inelasticity, and is found to propagate at a steady speed at late times. The granular temperature at the upstream end of the shock decay according to Haff's law [$\theta(t) \sim t^{-2}$], but the downstream temperature decays faster than its upstream counterpart. The Haff's law seems to hold inside the shock up-to a certain time for weak shocks, but deviations occur for strong shocks. The time at which the maximum temperature deviates from Haff's law follows a power-law scaling with upstream Mach number and the restitution coefficient. The continual build-up of density inside the shock is discussed, the origin of which seems to be tied to a pressure instability in granular gases. It is shown that the granular energy equation must be 'regularized' to arrest the maximum density, and the regularized hydrodynamic equations should be used for shock calculations (Reddy & Alam, 2015, J. Fluid Mech., to be published).

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