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A midsummer-night's shock wave MICHAEL HARGATHER, THOMAS LIEBNER, GARY SETTLES, Penn State — The aerial pyrotechnic shells used in professional display fireworks explode a bursting charge at altitude in order to disperse the "stars" of the display. The shock wave from the bursting charge is heard on the ground as a loud report, though it has by then typically decayed to a mere sound wave. However, viewers seated near the standard safety borders can still be subjected to weak shock waves. These have been visualized using a large, portable, retro-reflective "Edgerton" shadowgraph technique and a high-speed digital video camera. Images recorded at 10,000 frames per second show essentially-planar shock waves from 10- and 15-cm firework shells impinging on viewers during the 2007 Central Pennsylvania July 4th Festival. The shock speed is not measurably above Mach 1, but we nonetheless conclude that, if one can sense a shock-like overpressure, then the wave motion is strong enough to be observed by density-sensitive optics.

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