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**Particle-in-Cell Codes and the Hydrodynamic Limit: Testing the LSP Scattering Model with Shock Tube Problems**[1] BISHARA KORKOR, CHRIS ORBAN, DOUGLASS SCHUMACHER, RICHARD FREEMAN, The Ohio State University, Department of Physics, Columbus, OH 43210 — Shock waves and shock physics are important in a variety of experiments and applications such as inertial confinement fusion and ion acceleration. In an effort to benchmark the particle-in-cell code LSP in these situations where ion motion is significant, we studied shock tube problems which have exact analytic solutions. We studied both the traditional non-relativistic shock tube (Sod 1978) as well as a relativistic case (Marti and Mueller 2003). These problems begin from a discontinuous density and pressure profile resulting in a shock waves, rarefactions, and a contact discontinuity. The results were useful in determining which algorithms, resolutions, and simulation techniques successfully enable the code to accurately match the hydrodynamic limit. The insight gained from these comparisons have informed how the code should be run in simulations in which an exact solution does not exist and bolstered confidence that the shock physics is being adequately resolved.

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