1026-70-194 **Roy H. Goodman*** (goodman@njit.edu), Department of Mathematical Sciences, NJIT, University Heights, Newark, NJ 07102, and **Richard Habernan** (rhaberma@mail.smu.edu), Department of Mathematics, Southern Methodist University, Dallas, TX 75275. *Fractal Structure in Solitary Wave Interactions.*

The following scenario has been seen in many non-integrable, dispersive, nonlinear PDE over the last 25 years: two solitary waves are propagated on a collision course. Above some critical velocity v_c, they simply bounce off each other. Below v_c they may be captured and merge into a single localized mass, or they may interact a finite number of times before escaping each other's embrace. Whether they are captured, and how many times the solitary waves interact before escape, depends on the initial velocity in a complicated manner, often remarked, though never shown, to be a fractal (a chaotic scattering process). This has been observed in coupled NLS, sine-Gordon, ϕ^4, and others.

These PDE systems are commonly studied by (nonrigorously) deriving a reduced set of ODE that numerically reproduce this behavior. Using matched asymptotics and Melnikov integrals, we give asymptotic formulas for vc and for certain salient features of the fractal structure. We derive a discrete-time iterated map through which the entire structure can be unravelled. (Received February 26, 2007)