1046-35-1619   **Robin C Young*** (`young@math.umass.edu`), Mathematics and Statistics, University of Massachusetts, Amherst, MA 01035, and **J Blake Temple**. *On Shock-Free Periodic Solutions for the Euler Equations.*

We consider the existence of periodic solutions to the Euler equations of gas dynamics. Such solutions have long been thought not to exist due to shock formation, and this is confirmed by the celebrated Glimm-Lax decay theory for 2x2 systems. However, in the full 3x3 system, multiple interaction effects can combine to slow down and prevent shock formation. In this talk I shall describe the physical mechanism supporting periodicity, describe combinatorics of simple wave interactions, and develop periodic solutions to a "linearized" problem. These linearized solutions have a beautiful structure and exhibit several surprising and fascinating phenomena. I shall also discuss partial progress on the perturbation problem: this leads us to problems of small divisors and KAM theory. (Received September 16, 2008)