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**MS16: Nonlinear PDEs of Conservation  
Laws and Fluid Mechanics II**

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**Shock Formations for 3-Dimensional Wave  
Equations**

Shuang Miao, *University of Michigan*

In this talk I will present a geometric perspective on shock formations for a class of quasilinear wave equations which admit global smooth solutions with small data. We exhibit a family of smooth initial data leading to breakdown of smoothness of the solution. The work combines the ideas from fluid mechanics e.g. shock formation for Euler equations and from general relativity e.g. formation of trapped surfaces. This is a joint work with Pin Yu.

**Global Solutions to the Gas-Vacuum Inter-  
face Problem with Physical Singularity of  
Compressible Euler Equations with Damp-  
ing**

Huihui Zeng, *Tsinghua University and Harvard  
University*

I will present some recent results on the global solutions to the gas-vacuum interface problem of compressible Euler equations with physical singularity of the sound speed being  $C^{1/2}$ -Hölder continuous near vacuum boundaries. For this problem, the global existence and convergence to the Barenblatt self-similar solution of the induced porous media equation as time goes to infinity is proved, with detailed convergence rate. The long time asymptotics of the gas-vacuum interfaces are also given.

**On Rotating Star Solutions to the Euler-  
Poisson Equations – Inner Hard Core and  
Non-Isentropy**

Yilun Wu, *Indiana University*

The Euler-Poisson equations are used in astrophysics to model the motion of gaseous stars. Auchmuty and Beals in 1971 found a family of rotating star solutions by solving a variational free boundary problem. Recent interests in the astrophysics community suggest one to extend the picture to include a solid core together with its gravitational fields. In this talk, we will discuss several results in this direction. Furthermore, we will explore the effects of non-isentropic equation of state.

**Global Dynamics of a System of Hyperbolic  
Balance Laws Arising from Reinforced Ran-  
dom Walk**

Tao Luo, *Georgetown University*

In this talk, I will present some recent results joint with Zhouping Xin and Huihui Zeng on the global regularity and long time dynamics, in particular, the long time dynamics of the vacuum boundary, of solutions to a vacuum free boundary problem of viscous gaseous stars.