Theoretical Study of Heavy-ion Collisions

Catherine M. Mader

Physics and Engineering

mader@hope.edu

(616)395-7114

Education and experiences

Ph.D., Physics, Michigan State University (1993)
Colorado School of Mines B.Sc. (1987), M.Sc. (1989) Engineering Physics

Hope College: Chair, Department of Physics & Engineering (2004 - present), Visiting Assistant Professor (1993-1995) , Assistant Professor (1995 – 1999), Associate Professor (1999 -)

Lawrence Berkeley National Laboratory: Visiting Scientist (2000-2001)

Areas of expertise

Theoretical nuclear physics, Physics education, computer modeling

Grants and awards:

NSF Award #0452206 - Research Experiences for Undergraduates in Physics and Engineering at Hope College ($300,867)
NSF Award #0311152 - Adaptation of "6 Ideas that Shaped Physics" for Life-Sciences Majors ($46,945)
NSF Awards #9507852, #9800747 - RUI: Theoretical Study of the Space-Time Evolution of Heavy-ion Collisions at Hope College ($32,000, $34,339)
Research Corporation Cottrell College Science Award: A study of the space-time evolution of the hadronic reaction zone formed in heavy-ion collisions ($20,000)

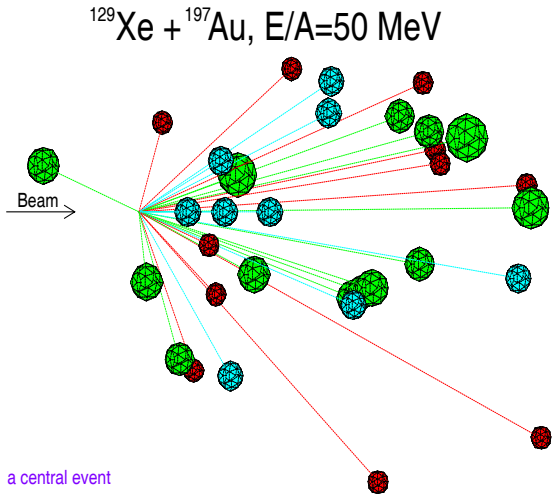
Key publications and presentations

C. M. Mader, et. al., " The three dimensional Ising model: A paradigm of liquid-vapor coexistence in nuclear multifragmentation", Phys. Rev. C68, 064601 (2003)
G. F. Peaslee, C. M. Mader, P. L. Jolivette, P. A. DeYoung, "The Restructured Advanced Laboratory at Hope College - A Step Toward Independence"; Application of Accelerators in Research & Industry: 15th International Conference, AIP Press 475, 1110-1113 (1999).
P. A. DeYoung, et. al., "Sensitivity of small-angle correlations of light charged particles to reaction mechanisms in the $^{16}O + ^{27}Al$ Reaction at 44 MeV/nucleon"; Phys. Rev. C56, 244 (1997).

Acknowledgements

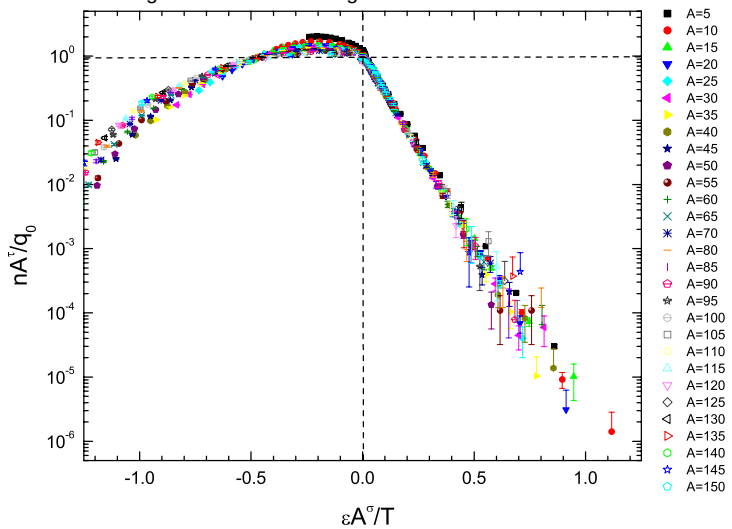
NSF, Research Corporation for funding

The concept of the strong nuclear interaction is discussed in all introductory physics courses, however we must tell the students that we don't have a complete mathematical model of the system. Unfortunately, these mesoscopic systems are difficult to study mathematically because they are too complex to treat exactly and too small to treat using thermal models.



However, using semi-classical models and thermal models for finite systems, we can gain insights into the system. In addition, the major features of these models are understood by undergraduates, which allows them to work with the computer models, modify the interactions used in the models and gain deeper understanding of the nuclear interaction while building their problem-solving skills and computer skills.

Protons, alpha particles and fragments emitted during a head-on Xenon on Gold collision.



Scaling of emitted fragment mass distributions produced in statistical model