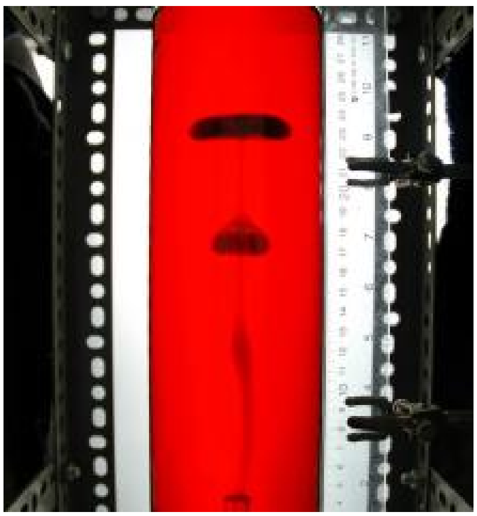
Physicists create supernova in a jar (w/ Video)

December 2 2010



A vertical tube of viscous solution contains stable reactants for the Iodate Arsenous Acid reaction. An indicator makes the solution red. Reaction is triggered at the base of a small tube at the bottom, leading to a growing plume that sheds accelerating vortex rings. No fluid is injected: all the buoyancy is created by the reaction itself. This image shows a pair of successive accelerating vortex rings launched by the plume. The process is analogous to the nuclear deflagration leading to the detonation of a type Ia supernova. Experiment by Michael C. Rogers

(PhysOrg.com) -- A team of physicists from the University of Toronto and Rutgers University have mimicked the explosion of a supernova in miniature.

A supernova is an exploding star. In a certain type of supernova, the detonation starts with a flame ball buried deep inside a white dwarf. The flame ball is much lighter than its surroundings, so it rises rapidly making a plume topped with an accelerating smoke ring.

"We created a smaller version of this process by triggering a special chemical reaction in a closed container that generates similar plumes and vortex rings," says Stephen Morris, a University of Toronto physics professor.

Autocatalytic chemical reactions release heat and change the composition of a solution, which can create buoyancy forces that can stir the liquid, leading to more reaction and a runaway explosive process. "A supernova is a dramatic example of this kind of self-sustaining explosion in which gravity and buoyancy forces are important effects. We wanted to see what the liquid motion would look like in such a self-stirred chemical reaction," says Michael Rogers, who led the experiment as part of his PhD research, under the supervision of Morris.

"It is extremely difficult to observe the inside of a real exploding star light years away so this experiment is an important window into the complex fluid motions that accompany such an event," Morris explains. "The study of such explosions in stars is crucial to understanding the size and evolution of the universe."

The research will appear in *Physics Review E* in the next few weeks.

Provided by University of Toronto