Animating Explosions

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Problem Statement:
Animating propagation of an explosion through the surrounding air using a computational fluid dynamics model based on the equations for compressible, viscous flow.

Challenges:
- We cannot capture many of the visual effects of an explosion in a complex setting if we rely only on an analytical model of the blast wave; a fluid dynamics model of the air is necessary to capture these effects
- An explosion causes a variety of visual effects in addition to the light refraction by the blast wave. An initial chemical or nuclear reaction often causes a blinding flash of light. Dust clouds are created as the blast wave races across the ground, and massive objects are moved, deformed, or fractured. Hot gases and smoke form a rising fireball that can trigger further combustion or other explosions and scorch surrounding objects

Key Ideas:
- Using computational fluid dynamic approach.
- Model explosions as compressible, viscous flow.
- Solving the flow equations with a modified integration method. It handle extreme shocks and supersonic velocities.
- Two way coupling between dynamic objects and fluids

Implementation Approach:
- Use fluid dynamics and conservation of mass, momentum and energy to get the acceleration for each particle.
- Using the above acceleration, calculate the new velocity and position for each particle after the timestep.
- Calculate properties afterwards like temperature and density for the explosion particles.

Result Summary:
1. The expected final result is to have physically realistic model of explosions
2. Simulate Blast and Pressure wave for the explosion
3. Successful viscous flow model implementation of the explosion