

The Navier-Stokes Equations

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We are surrounded by fluids in motion. As a consequence, they were among the first physical systems that physicists and applied mathematicians tried to model and the currently accepted mathematical model for fluid motion, the Navier-Stokes equations, are more than 150 years old. Because they have been studied for so long, one might assume that all the interesting mathematical questions about these equations have been answered. However, when the Clay Mathematics Foundation made a list of seven "Millennium Prize Problems" (with a one million dollar prize for their solution), one of the seven was to show that the three-dimensional Navier-Stokes equations has a smooth solution. I will explain the physical origin of these equations, some of the surprising phenomena that appear in these equations, and why they are so hard to solve.