Dynamics of a Gas Bubble in a Compressible Fluid

Speaker: Dr. Abby Shaw-Krauss
Columbia University

Abstract: In this talk, I will discuss the dynamics of a nearly spherical gas bubble in an inviscid, compressible fluid with surface tension. The time-decay of symmetric (volume) and asymmetric (shape) deformation modes is governed by scattering resonances. These are complex eigenvalues of a non-self-adjoint spectral problem associated with the linearization about the spherical equilibrium. The locations of these scattering resonance energies are studied using asymptotics supported by high-precision numerics. When fluid compressibility is nonzero, there are bubble shape modes persisting on much longer time scales than the symmetric mode. Resonance expansion solutions for the bubble surface perturbation and fluid velocity potential are found by proving a general result estimating the Neumann to Dirichlet map for the wave equation exterior to a sphere. I will also discuss nonlinear effects, specifically the excitement of bubble translation due to interacting shape modes. Joint work with Michael I. Weinstein (Columbia University).