ACOUSTICS2008/318
Nonlinear dynamics of sonoluminescing bubbles

Joachim Holzfuss
Institute of Applied Physics, TU Darmstadt, Schlossgartenstr. 7, 64289 Darmstadt, Germany

The current work focuses on the acoustical and nonlinear dynamical aspects of sonoluminescence (SBSL). Several hydrodynamical instabilities in parameter space are analyzed in detail numerically. Their occurrence in experiments is discussed especially in the context of period doubled unisotropic light emission. The acoustical emissions during stable and unstable oscillations show characteristics of shock waves. The emitted sound generates a complex acoustic environment in the driving cell leading to backreactions to the bubble. Characteristic dynamical effects during unstable sonoluminescence are clarified. Chemical processes during high temperature and high pressure, spatial translations, gas diffusion, the highly nonlinear bubble oscillations and acoustic emissions are attributed to oscillations and modulations of bubble dynamics outside the range of stable SBSL. In particular reasons for quasiperiodic oscillations with incommensurate frequencies in different setups are found.