Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Applications of Sonoporation: Acoustically-Stimulated Nonspherical Collapse and Jetting of Multiple Bubbles Near a Surface
MICHAEL L. CALVISI, QIAN XI WANG, JOHN R. BLAKE, School of Mathematics, University of Birmingham, UK — Nonspherical bubble collapse is a means to enhance permeability and transfect drugs and genes to cells in the process of sonoporation. In this non-invasive procedure, microbubbles injected into the bloodstream are stimulated by ultrasound, which induces nonspherical collapse and the formation of high-speed microjets directed towards the tissue surface. This jetting mechanism consequently creates a pathway for drugs or genes to enter the cellular body. The dynamics of bubble collapse are affected not only by the imposed acoustic field, but also by the properties of the bubble's surface coating, the compliance of the tissue surface, and the presence of nearby bubbles. In this talk, results from numerical models using the Boundary Integral Method are presented that help elucidate the interplay of these various factors in effecting jetting and targeted drug delivery. Numerical results are compared to recent experiments involving the acoustic stimulation of two microbubbles near a compliant surface.

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Date submitted: 03 Aug 2007 Electronic form version 1.4