Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Acoustic, thermal and chemical response of single bubble collapse at audible frequencies and high amplitudes[1] DAVIDE MASIELLO, PRASHANT VALLURI, IGNACIO TUDELA, The University of Edinburgh, STEPHEN SHAW, Xi'an Jiaotong-Liverpool University (XJTLU), RAMA GOVINDARAJAN, International Centre fo Theoretical Sciences (ICTS) — Despite its probable feasibility, the use of sound frequencies lower than 20 kHz for acoustic cavitation has been subject to very little examination. In this work, a new formulation for the mass and heat transfer based on a boundary layer method has been coupled to classical hydrodynamic equations in order to model acoustically forced gas/vapor micro-bubbles in water. By accounting for all the critical thermo-mechanical contributions, the proposed model is shown to be robust enough so to be employed in the investigation of a large parameter space (frequency x amplitude =[1-100 kHz] x [1-7.5 atm]). Our results in the low frequency range suggest an increasingly important role of water vapor segregation in slowing down the bubble collapse, yielding a remarkably different behavior where the first collapse is not necessarily the strongest one. Moreover, the bubble response in terms of peak temperature and chemical production appears to be comparable to the high-frequency cases, thus casting renewed interest in the study of low frequencies for a variety of engineering applications.

[1]This project is co-funded by ThermaSMART under the European Unions Horizon 2020 research and innovation programme under the Marie Skodowska-Curie grant agreement No. 778104

Davide Masiello
The University of Edinburgh

Date submitted: 03 Aug 2020 Electronic form version 1.4