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Cavity-mediated collective heating in opaque sonoluminescence bubbles

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Sonoluminescence is the intriguing phenomenon of energy concentration from an oscillating pres- sure field into a brief pulse of light via the actions of a bubble filled with atomic species. Since its discovery, there have been many theories on what mechanisms must be at work. The phenomenon attracted the interests of scientists from a wide range of disciplines, including physics, chemistry and engineering. In this paper, we develop a quantum optical model to analyse the dynamics of the atoms during the bubble collapse phase. Our model uses ideas of analogous work on cavity-mediated collective laser cooling of an atomic gas to very low temperatures and predicts many aspects of actual sonoluminescence experiments correctly. For example, we identify a mechanism responsible for the sudden emission of light during each bubble collapse phase. Moreover, our model might explain why certain atomic species in sonoluminescing bubbles become hotter than what one would expect from thermodynamic heating by rapid compression. In the long-term, our work might help to further increase the temperature of sonoluminescing bubbles for applications in sonochemistry, medicine, and the study of small volume plasmas.

Biography

Almut Beige completed her PhD in 1998 at the University of Goettingen in Germany. She is the Head of the Theoretcial Physics Group in the School of Physics and Astronomy at the University of Leeds, which she joined after working at Imperial College London and the Max-Planck Institute for Quantum Optics in Garching in Germany. She published 80 scientific papers, has an H-index of 23 and more than 2000 citations listed on ISI Web of Science. She currently serves on the Editorial Board of *Journal of Modern Optics and European Physics Journal D*.

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