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PREPRINT

Computed Spectral and Temporal Emissions from a Sonoluminescing Bubble

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pulse widths that were reported originally implied that a very fast mechanism, such as “normal” plasma thermal conduction ($\sim T^{5/2}$) was responsible for removing energy from the bubble. Coincident with the reporting of the longer pulse widths, F. MacIntyre made the observation that the SBSL plasma has a very small Debye screening length (5), which means that the electrons are close to the ions and almost completely screen the ionic electric fields. Consequently, the plasma behaves like a typical dense fluid with two-components (ions and electrons) whose transport properties arise from collisional rather than coulombic interactions. This type of plasma is called a “strongly coupled plasma.” The main difference between this strongly coupled plasma and the “normal” plasma described earlier is that the rate of energy loss by plasma thermal conduction is much less in the strongly coupled plasma ($\sim T^{1/2}$ for both ions and electrons), which gives rise to longer and variable calculated pulse widths that are consistent with the new experimental measurements.

We note that these refinements in our model do not change the qualitative results of our previous work. They improve the quantitative results and our predictive capability. We will demonstrate this by showing comparisons of our SBSL numerical simulations and recent experimental data (1, 6). We will also show results of 2D simulations of SBSL in a uniform magnetic field. Experimental data show that SBSL is quenched by a sufficiently large magnetic field (7). Our calculations show that the magnetic field induces an aspherical collapse that reduces the peak temperature in the gas and quenches SBSL. The calculated quenching is consistent with experimental data.

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