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Effect of an obstacle on Rayleigh acoustic streaming cells

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Acoustic streaming has harmful consequences on thermoacoustic machines behaviour because of the associated heat transfers. A preliminary study was carried out in order to study the effect of an obstacle on the Rayleigh cells to help in understanding the role of such phenomena in thermoacoustic machines. An obstacle was introduced in a half-wavelength cylindrical wave guide to study its effects on acoustic streaming. The obstacle was placed at various positions along the wave guide axis and experiments were carried out at various acoustic levels. The axial streaming velocity was measured using Laser Doppler Velocimetry (LDV). It was observed that adding an obstacle in the streaming pattern modifies the latter and that new streaming vortices appear in the vicinity of the obstacle. When the obstacle position approaches a maximum of the Rayleigh streaming velocity the number and the amplitude of acoustic streaming vortices at the ends of the obstacle increase. Similar tendencies were observed when the acoustic velocity amplitude was increased. Because streaming in the vicinity of the obstacle end is complex and has a high amplitude, heat effects can be expected to be important and complex at the ends of the thermoacoustic stack where heat exchangers are located.