Suppression of Instabilities in the Laser Discharge by Acoustic Waves

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Random perturbations arising in the laser gas discharge at intermediate pressures, cause the development of instabilities, resulting in a violation of its spatial state, i.e. leads to the formation of strata – decomposition of positive column along the current, to the contraction of positive column plasma in the transverse direction in the cord and raise the temperature of the gas in the region near the axis. All this leads to the disruption generation induced, monochromatic radiation \([1]\). To overcome these phenomena and the creation of a stable stationary gas discharge at elevated pressures via positive column high-speed flow of gas that generates in the chamber turbulence, causing mixing of the plasma in the transverse direction, creating a homogenous, stable pillar of ionized gas with a population inversion \([2]\).

Convection in the high-speed laser gas flow is ensured by a pump located in a closed loop setup with heat exchanger cooling the gas. In this paper we propose to significantly simplify the design of the gas laser and simmer for emerging instability in a plasma acoustic waves, directed along the discharge.

An increase in the intensity of the sound is directed along the gas discharge causes the occurrence of acoustic vortices, which lead to mixing of the plasma in the transverse direction and the creation of uniform sustainable positive column at elevated pressures. The dependences of the current density distribution along the radius of the discharge in the absence of acoustic waves, which yields ionized laced post with a bell-shaped distribution of electron concentration along the radius of the tube, and in the presence of a sound with an intensity of 86 dB with a parabolic shape of electron density over the cross section of the pillar and homogenous filling the chamber with plasma. The creation of optical quantum generator on carbon dioxide at elevated pressure with the stabilization of the discharge by acoustic waves will greatly simplify design of high-power CO\(_2\) laser.

References