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INFLUENCE OF BUFFER GASES ON THE PERFORMANCE OF OPTICALLY PUMPED MID INFRA-RED NH_3 LASERS

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Optically pumped mid infra-red NH_3 lasers[1,2], are a promising class of resonantly pumped devices which can extend the output wavelengths of coherent radiation into the 11 - 13 μm range. Emissions at 12.8 μm and 12.08 μm from molecular NH_3 gas can be obtained when pumped with the R(16) and the R(30), 9 μm transitions respectively of a CO_2 laser; the output energy being limited to several hundreds of millijoules.[2] The addition of buffer gases such as N_2 and He however, increases the output energy by 3 - 7 folds.

A simple set of kinetic equations for the population of the vibration rotational levels of NH_3 has been developed to analyse the population inversion conditions and laser action. They have also been used to predict the shape of the optically pumped pulse which seems to agree reasonably well with the experimental results[1].

The enhancement of output energy in the presence of buffer gases can be attributed to the following reasons. First, collisions between NH_3 and the buffer gas molecules may decrease the rotational relaxation times in the excited band thus populating many rotational states. Secondly, the collisions may deplete some of the rotational states in the ground state.

References

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