** LIST OF PAPERS PRESENTED/COMMUNICATED **

1. Bote S.R. and Soudagar M.K., "Self-focusing of TEM_{10} and TEM_{20} Laser Modes in Strongly Ionized Plasma.", IV National Symposium on Plasma Science and Technology Institute for Plasma Research, Bhat, Gandhinagar (Gujarat), 28-30 December 1987.

2. Shedam, M.R., Bote S.R. and Soudagar M.K., "On Steady-state Self-focusing of TEM_{00} and TEM_{10} Laser Modes in saturating Media and Semiconductors". Seventy Fifth Session of the Indian Science Congress Pune, 1988.

3. Bote S.R. and Soudagar M.K., "Propagation of Donought (TEM^{*}_{01}) Mode Laser Beam in Semiconductors" (Communicated to Ind.J. Pure and Appl.Phys.).

4. Bote S.R. and Soudagar M.K., "Cross Focusing of TEM_{00} and TEM^{*}_{01} Mode Laser Beams in Parabolic Medium". (communicated to Ind.J.Pure and Appl. Phys.)

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THEORETICAL INVESTIGATIONS ON SELF-FOCUSING OF TEM_{10} AND TEM_{20} LASER MODES IN STRONGLY IONIZED PLASMA

S. R. BOTE
Kisanveer Mahavidylaya, Wai, Dist. Satara
M. R. SHEDAM
The New College, Kolhapur
and
M. K. SOUDAGAR
Department of Physics, Shivaji University, Kolhapur

In various theoretical approaches to the problem of self-focusing of laser beams in plasmas, mostly the propagation of TEM_{00} mode is assumed mainly because of its Gaussian intensity profile which leads to simplifications of the otherwise mathematical complexity of the problem. With a view to exploit the use of higher order modes, particularly TEM_{10} modes which have Gaussian like intensity profiles with additional secondary maxima around the central peak, we have considered in this paper the propagation of TEM_{10} and TEM_{20} isolated modes in a strongly ionized plasma under the WKB approximation and the parabolic wave equation approach.

The intensity distribution of each mode is first calculated under the paraxial ray approximation. Using this distribution, expressions for the electron temperature and excess carrier concentration in plasma are obtained. These are utilized to evaluate the nonlinear refraction force and its behaviour with the radial intensity. The resulting expressions are then employed in establishing the second order differential equation for the beam-width parameter of each laser mode. The numerical solutions of both the equations have been obtained for typical sets of parameters. The variation of beam-width parameters with the distance of propagation in the plasma is also displayed.

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3. On Steady-state Self-focusing of TEM_{00} and TEM_{10} Laser Modes in Saturating Media and Semiconductors.

M. R. Shedam
New College, Kolhapur
S. R. Bote
Kisanveer Mahavidyalaya,
Wai, Dist : Satara
and
M. K. Soudagar
Department of Physics,
Shivaji University,
Kolhapur—416 004.

The fundamental TEM_{00} laser mode is preferred in practical applications and in theoretical approaches to the problem of self-focusing. This preference seems to be one of the reasons for not using other laser modes. We have therefore considered theoretically the self focusing of TEM_{00} and TEM_{10} laser modes in this paper.

By series solution method we have studied the steady-state self-focusing in a medium with a dielectric constant profile.

$$\epsilon \cong \epsilon_0 + \frac{1}{2}\epsilon_2 A^2_0 - \frac{\epsilon_2 A^4_0}{8\epsilon_0}$$

A differential equation for the beam-width parameter is established. Its solution under geometrical approximation suggests that the self focusing of TEM_{00} mode in this medium is possible subject to the condition $\epsilon_0 - 3/\epsilon_2 E^2_0 > 0$

We have also obtained a second order differential equation for the beam width parameter of TEM_{10} mode in semiconductors. For appreciable self focusing of this mode

in parabolic semiconductors we find that the following condition should hold good :

$$\frac{6\exp(-kiz)}{R^2_n} > \frac{32}{R^2_d}$$

This is in accordance with the well-known condition that $R_n < R_d$.

Our work suggests that the higher order TEM_{10} modes, which have Gaussian like intensity profiles with additional secondary peaks around the central maximum, may be exploited in the study of self focusing.