

OPTICAL GUIDING BY A FREE ELECTRON LASER*)

E.T. Scharlemann

University of California, Lawrence Livermore National Laboratory, Post
Office Box 808/L-321, Livermore, CA 94550

A.M. Sessler and J.S. Wurtele

Lawrence Berkeley Laboratory, One Cyclotron Road/58-101, Berkeley, CA 94720

ABSTRACT

The coherent interaction between an optical wave and an electron beam in a free electron laser (FEL) is shown to be capable of optically guiding the light. The effect is analyzed using a two-dimensional approximation for the FEL equations, and using the properties of optical fibers. Results of two-dimensional (cylindrically symmetric) numerical simulations are presented, and found to agree reasonably well with the analytically derived criterion for guiding. Under proper conditions, the effect can be large and has important application to short wavelength FEL's and to directing intense light.

*) To be published in "Proceedings of the Workshop on Coherent and Collective Properties in the Interaction of Relativistic Electrons and Electro-magnetic Radiation, Como, September 1984" which will form a special issue of Nuclear Instruments and Methods in Phys. Res. (1985).