

ABSTRACT

A reformulation of nondiffracting beams, based on more general (travelling wave) solutions of the non-paraxial wave equation, is presented.

Zero order nondiffracting beams are found to be radial standing waves arising from counterpropagating zero order Hankel waves of the first and second kind, while higher order nondiffracting beams are formed from counter-rotating spiral waves which are described by Hankel functions of the corresponding order.

The resulting physical picture is more general than the well-known integral representation of Bessel functions and we expect it to have implications for studies of the applications of nondiffracting beams.

Generic descriptions of the transverse profiles of the electric field, applicable to experimental configurations for realising nondiffracting beams, follow directly from this formulation.

Finally, the existence of classes of periodically nondiffracting beams, possessing finite angular momentum and having the characteristics of rotating and spiral waves, is predicted.