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High-frequency eigenmodes of a coaxial wave guide containing a relativistic annular electron beam with a coaxial wiggler[1] MAJID SHAHRIARI — An analysis of the high-frequency eigenmodes of a coaxial wave guide containing a magnetized annular plasma column with a one-dimensional coaxial wiggler is presented. A transcendental equation is derived from the boundary conditions in the form of an eighth-order determinant equated to zero. Simultaneous solution of this determinantal equation and a polynomial equation derived from the wave equation yield the dispersion relations for the eigenmodes. By reduction of the order of the determinant the appropriate transcendental equation is easily obtained for some special cases, e.g., conventional wave guide containing an annular plasma column under electrostatic approximation. Numerical solutions are obtained for space-charge modes, and cyclotron modes. This treatment shows that dispersion curves are dependent on $d\gamma/dt$ and B_w, ignored in previous works. The difference between relativistic modes with effect of wiggler field and nonrelativistic cases is shown. This study is benefiting to improve the devices for generation of high-power electromagnetic radiation, charged particle acceleration, and other applications of plasma waveguide.

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