2.2 FORMULATION

The model for the problem assumes that the source wave is an elliptically polarized electromagnetic wave having frequency ω_o traveling in free space in the positive z direction.

$$\vec{e_i}(z,t) = (p\hat{x} \mp jq\hat{y})E_o \exp[j(\omega_o t - k_o z)] \qquad t<0 \qquad (2.1)$$

$$\vec{h_i}(z,t) = (\pm jq\hat{x} + p\hat{y})H_o \exp[j(\omega_o t - k_o z)] \qquad t<0 \qquad (2.2)$$

where the upper sign is for a right-hand elliptically polarized source wave and the lower sign is for a left-hand elliptically polarized source wave. If $p = 1$ and $q = 1$, the source wave is circularly polarized. In addition to the plane wave, a magnetic wiggler field $\vec{B_w}$ is also present.

$$\vec{B_w} = \hat{y} B_{wo} \sin(k_w z + \phi_w) \qquad (2.3)$$

This expression is an approximation of the actual magnetic wiggler field and is valid provided that the amplitude of the periodic motion of the electron is small relative to the scale length of the magnetic wiggler [3].

At t = 0, the free electron density of the medium is suddenly increased from zero to a constant N_o, creating a plasma medium with plasma frequency ω_p where:

$$\omega_p = \sqrt{\frac{N_o q^2}{m \varepsilon_o}} \tag{2.4}$$

In equation (2.4), q is the absolute value of the charge of an electron (not to be confused with q in 2.1), m is the mass of an electron, and ε_o is the permittivity of free space. Figure 2.1 shows the geometry of the problem.

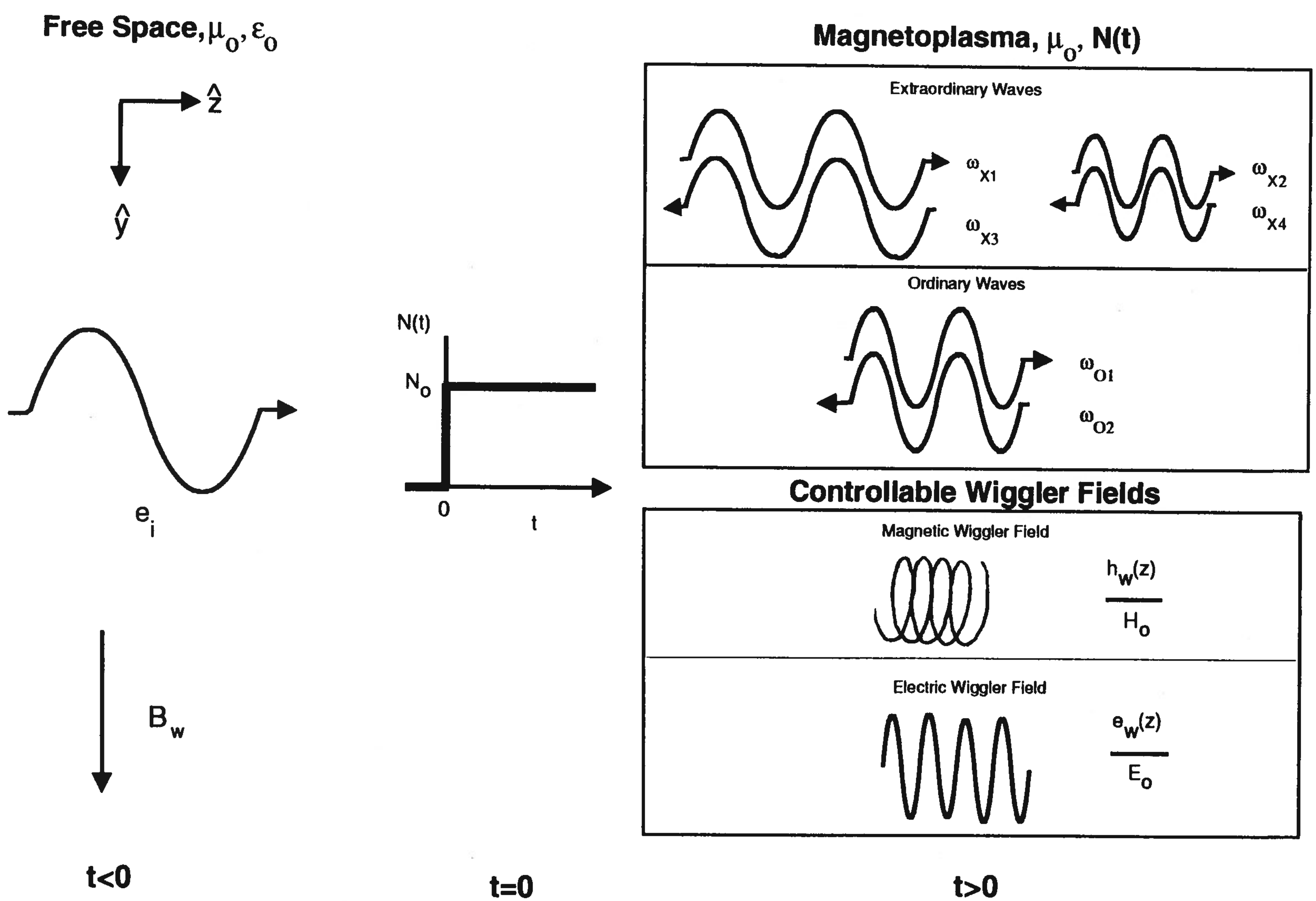

Figure 2.1 Geometry of the problem.