1)

THE TOMITA CHAO EFFECT

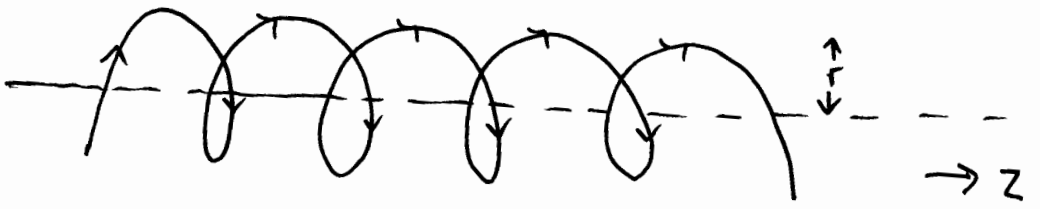
Consider a light beam propagating in a helix made up of an optical fiber. The propagation is described by the rotating and translating tetra

$$\underline{V}^{(1)} = \frac{1}{\sqrt{2}}\left(\underline{i} - i\underline{j}\right) e^{i(\omega t - \kappa z)} \quad -(1$$

where:

$$\kappa = \frac{\omega}{c} = \frac{1}{r}. \quad -(2)$$

Here r is the radius of the fiber and z is the length along the fiber that the light beam has travelled.



Therefore the Tomita Chao phase can be expressed most simply as:

$$\boxed{\phi = \frac{z}{r} = 2\pi\left(1 - \cos\lambda\right)} \quad -(3)$$

It can be seen from eq. (3) that the phase ϕ is geometrical. It is due to spacetime translating and rotating along the helix generating the electromagnetic potential:

$$\underline{A}^{(1)} = A^{(0)}\,\underline{V}^{(1)}. \quad -(4)$$