1) 181(3): The Fundamental Assumption of the de Broglie / Einstein Equations.

The de Broglie Einstein equations can be condensed into:

$$p^\mu = \left(\frac{E}{c}, \underline{p}\right) = \hbar\left(\frac{\omega}{c}, \underline{\kappa}\right) \quad -(1)$$

$$= \gamma m_0 (c, \underline{v}) \quad -(2)$$

where m_0 is the measured mass. Therefore:

$$p^\mu p_\mu = \gamma^2 m_0^2 (c^2 - v^2)$$

$$= \gamma^2 m_0^2 c^2 \left(1 - \frac{v^2}{c^2}\right). \quad -(2)$$

However:

$$\gamma^2 = \left(1 - \frac{v^2}{c^2}\right)^{-1}, \quad -(3)$$

therefore:

$$p^\mu p_\mu = m_0^2 c^2 \quad -(4)$$

which is the Einstein energy equation, and:

$$p^\mu p_\mu = \hbar^2 \left(\frac{\omega^2}{c^2} - \kappa^2\right). \quad -(5)$$

For the hypothetically massless particle:

$$m_0 = 0 \quad -(6)$$

and

$$\frac{\omega}{c} = \kappa. \quad -(7)$$

2)

The fundamental problem of the de Broglie Einstein approach is that it does not change the structures (1) and (2) in particle collision theory.

ECE theory shows that during particle collisions, the Einstein energy equation (4) is changed to:

$$\boxed{p^\mu p_\mu = \hbar^2 \kappa^\mu \kappa_\mu + m_0^2 c^2} \quad -(8)$$

where:

$$\kappa^\mu \kappa_\mu = \frac{\omega_1^2}{c^2} - \kappa_1^2 \quad -(9)$$

of the matter wave. This changes the entire basis of particle and scattering theory, a conclusion which was indicated by UFT 158 ff and UFT 171.

Eq. (8) can be written as:

$$p^\mu p_\mu = \left(m_1^2 + m_0^2\right) c^2 \quad -(10)$$

where

$$\hbar^2 \kappa^\mu \kappa_\mu = m_1^2 c^2, \quad -(11)$$

i.e.

$$\boxed{\begin{aligned} \kappa^\mu \kappa_\mu &= \left(\frac{m_1 c}{\hbar}\right)^2 \\ &= \left(\frac{\omega_1}{c}\right)^2 - \kappa_1^2 \end{aligned}} \quad -(12)$$

and the quantity m_1 with the dimensions of mass is not a constant. If we define:

$$m^2 := m_1^2 + m_0^2 \quad -(13)$$

then

$$p^\mu p_\mu = m^2 c^2 \quad -(14)$$

and the Einstein de Broglie equations become:

$$E = \hbar\omega = \gamma m c^2 \quad -(15)$$

$$\underline{p} = \hbar \underline{\kappa} = \gamma m \underline{v} \quad -(16)$$

where m can be a variable defined by:

$$m^2 = \left(\frac{\hbar}{c}\right)^2 \kappa^\mu \kappa_\mu + m_0^2, \quad -(17)$$

i.e.

$$\boxed{m^2 = \left(\frac{\hbar}{c}\right)^2 \left(\frac{\omega_1^2}{c^2} - \kappa_1^2\right) + m_0^2} \quad -(18)$$

It is seen that m^2 can be real or imaginary, depending on whether $(\omega_1 / c)^2$ is greater than or less than κ_1^2.