Dirac Optical Model of (e,e'p)

1. General References

- A. Picklesimer, J. W. Van Orden and S. J. Wallace, Phys. Rev. C **32**, 1312 (1985)
- A. Picklesimer and J. W. Van Orden, Phys. Rev. C **40**, 290 (1989).

2. Current Matrix Element

$$J^\mu = \int \frac{d^3p}{(2\pi)^3} \bar{\psi}^{(-)}_{p's'}(\mathbf{p}) J^{(1)\mu}(q) \psi_i^{SM}(\mathbf{p}-\mathbf{q})$$

3. Bound State Wave Function

⋆ Mean field, Walecka Model

$$\gamma \cdot p - m + \gamma^0 V_V - V_S = 0$$

- C. J. Horowitz and B. D. Serot, Nucl. Phys. **A368**, 503 (1981).

4. Scattering Wave Function

- ⋆ Single-particle Dirac optical potential
- ⋆ Impulse approximation optical potential using Love-Franey parameterization

- A. Picklesimer, P. C. Tandy, R. M. Thaler and D. H. Wolfe, Phys. Rev. C **29**, 1582 (1984); **30**, 1861 (1984).
- M. V. Hynes, A. Picklesimer, P. C. Tandy, and R. M. Thaler, Phys. Rev. Lett. **52**, 978 (1984); Phys. Rev. C **31**, 1438 (1985).

5. Current Operator

- ⋆ Single-particle Dirac current operator

$$J^{(1)\mu}(q) = F_1(Q^2)\gamma^\mu + \frac{F_2(Q^2)}{2m} i\sigma^{\mu\nu} q_\nu$$

6. Limitations

- ⋆ The DWIA approach is not dynamically consistent.
- ⋆ As a result the electromagnetic current is not conserved.