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Demostrar que $\{\Pi(x), \Pi(y)\} = 0$ y $\{\phi(x), \phi(y)\} = 0$

Corchete de Poisson

$$\{A, B\} = \int_{-\infty}^{\infty} dx \left(\frac{\delta A}{\delta \phi_{(x)}} \frac{\delta B}{\delta \Pi_{(x)}} - \frac{\delta B}{\delta \phi_{(x)}} \frac{\delta A}{\delta \Pi_{(x)}} \right)$$

Consideramos

$$A_{[\phi_{(x)}]} = \phi(x)$$

$$\{\phi_{(x)}, \phi_{(y)}\} = \int_{-\infty}^{\infty} dz \left(\frac{\delta \phi_{(x)}}{\delta \phi_{(z)}} \frac{\delta \phi_{(y)}}{\delta \Pi_{(z)}} - \frac{\delta \phi_{(x)}}{\delta \Pi_{(z)}} \frac{\delta \phi_{(y)}}{\delta \phi_{(z)}} \right)$$

pero $\dfrac{\delta \phi(x)}{\delta \phi(y)} = \delta(x-y)$ (ver capítulo 37)

y $\dfrac{\delta \phi(x)}{\delta \Pi(y)} = 0$ pues ϕ no depende del campo Π

$$\{\phi_{(x)}, \phi_{(y)}\} = \int_{-\infty}^{\infty} dz \left(\delta(x-z) \cdot 0 - 0 \cdot \delta(y-z) \right)$$

$$\boxed{\{\phi_{(x)}, \phi_{(y)}\} = 0}$$

$$\{\Pi_{(x)}, \Pi_{(y)}\} = \int_{-\infty}^{\infty} dz \left(\underbrace{\frac{\delta \Pi_{(x)}}{\delta \phi_{(z)}}}_{0} \underbrace{\frac{\delta \Pi_{(y)}}{\delta \Pi_{(z)}}}_{\delta(y-z)} - \underbrace{\frac{\delta \Pi(x)}{\delta \Pi(z)}}_{\delta(x-z)} \underbrace{\frac{\delta \Pi(y)}{\delta \phi_{(z)}}}_{0} \right)$$

$$\boxed{\{\Pi(x), \Pi(y)\} = 0}$$

NOTA