

場の量子論 p320check11.6

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2024 年 10 月 20 日

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$$J^{ij}|\mathbf{k}=0\rangle = J^{ij}a^\dagger(\mathbf{k}=0)|0\rangle \quad (1)$$

$$= J^{ij}a^\dagger(\mathbf{k}=0)|0\rangle - a^\dagger(\mathbf{k}=0)J^{ij}|0\rangle \quad (2)$$

$$= [J^{ij}, a^\dagger(\mathbf{k}=0)]|0\rangle \quad (3)$$

$$= [J^{ij}, -(f_{\mathbf{k}=0}^{(-)}|\phi\rangle)]|0\rangle \quad (4)$$

$$= i(f_{\mathbf{k}=0}^{(-)}|(x^i\partial^j - x^j\partial^i)\phi)|0\rangle \quad (5)$$

$$= \int d\mathbf{x} \{-f_{\mathbf{k}=0}^{(-)*}[(x^i\partial^j - x^j\partial^i)(\partial^0\phi)] + (\partial^0 f_{\mathbf{k}=0}^{(-)*})[(x^i\partial^j - x^j\partial^i)\phi]\}|0\rangle \quad (6)$$

$$= \int d\mathbf{x} \{[(x^i\partial^j - x^j\partial^i)f_{\mathbf{k}=0}^{(-)*}](\partial^0\phi) - [(x^i\partial^j - x^j\partial^i)(\partial^0 f_{\mathbf{k}=0}^{(-)*})]\phi\}|0\rangle \quad (7)$$

$$= 0 \quad (8)$$

参考文献

- [1] 坂本眞人著「場の量子論-不変性と自由場を中心にして」(裳華房,2014,ISBN9784785325114)