

場の量子論 p325check11.9

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$$G = \int d^3\mathbf{k}' g(\mathbf{k}') a^\dagger(\mathbf{k}') a(\mathbf{k}') \quad (1)$$

$$[G, a^\dagger(\mathbf{k})] = \int d^3\mathbf{k}' g(\mathbf{k}') [a^\dagger(\mathbf{k}'), a^\dagger(\mathbf{k})] a(\mathbf{k}') + \int d^3\mathbf{k}' g(\mathbf{k}') a^\dagger(\mathbf{k}') [a(\mathbf{k}'), a^\dagger(\mathbf{k})] \quad (2)$$

$$= 0 + \int d^3\mathbf{k}' g(\mathbf{k}') a^\dagger(\mathbf{k}') \delta(\mathbf{k}' - \mathbf{k}) \quad (3)$$

$$= +g(\mathbf{k}) a^\dagger(\mathbf{k}) \quad (4)$$

$$[G, a(\mathbf{k})] = \int d^3\mathbf{k}' g(\mathbf{k}') [a^\dagger(\mathbf{k}'), a(\mathbf{k})] a(\mathbf{k}') + \int d^3\mathbf{k}' g(\mathbf{k}') a^\dagger(\mathbf{k}') [a(\mathbf{k}'), a(\mathbf{k})] \quad (5)$$

$$= - \int d^3\mathbf{k}' g(\mathbf{k}') \delta(\mathbf{k}' - \mathbf{k}) a(\mathbf{k}') + 0 \quad (6)$$

$$= -g(\mathbf{k}) a(\mathbf{k}) \quad (7)$$

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)