

場の量子論 p278check10.6

谷脇 貞善

2024 年 9 月 7 日

1 本文

$$J^+ = J^1 + iJ^2, \quad J^- = J^1 - iJ^2 \quad (1)$$

$$[J^1, J^2] = iJ^3, \quad [J^2, J^3] = iJ^1, \quad [J^3, J^1] = iJ^2 \quad (2)$$

$$[J^2, J^1] = [J^2 J^2, J^1] + [J^3 J^3, J^1] \quad (3)$$

$$= J^2 J^2 J^1 - J^2 J^1 J^2 + J^2 J^1 J^2 - J^1 J^2 J^2 + J^3 J^3 J^1 - J^3 J^1 J^3 + J^3 J^1 J^3 - J^1 J^3 J^3 \quad (4)$$

$$= J^2 [J^2, J^1] + [J^2, J^1] J^2 + J^3 [J^3, J^1] + [J^3, J^1] J^3 \quad (5)$$

$$= -iJ^2 J^3 - iJ^3 J^2 + iJ^3 J^2 + iJ^2 J^3 \quad (6)$$

$$= 0 \quad (7)$$

$$[J^2, J^2] = [J^2, J^3] = [J^2, J^+] = [J^2, J^-] = 0 \quad (8)$$

$$[J^3, J^+] = [J^3, J^1] + i[J^3, J^2] \quad (9)$$

$$= iJ^2 + J^1 \quad (10)$$

$$= J^+ \quad (11)$$

$$[J^3, J^-] = [J^3, J^1] - i[J^3, J^2] \quad (12)$$

$$= iJ^2 - J^1 \quad (13)$$

$$= -J^- \quad (14)$$

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)