⑦

時刻t−ε の量子状態を時刻tの量子状態に変更する

$|\nu(\square+\varepsilon)>$ ← $|\nu>$

$$\lim_{\varepsilon\to+0}\frac{1}{\varepsilon}[\underbrace{Z^\dagger(a_1-\varepsilon)\cdots Z^\dagger(a_n-\varepsilon)|0>}_{|\nu(\square+\varepsilon)>}-\underbrace{Z^\dagger(a_1)\cdots Z^\dagger(a_n)|0>}_{|\nu>}]$$

$$=\sum_{k=1}^{n}\lim_{\varepsilon\to+0}\frac{1}{\varepsilon}Z^\dagger(a_1)\cdots[Z^\dagger(a_k-\varepsilon)-Z^\dagger(a_k)]\cdots Z^\dagger(a_n)|0>$$

$$=\lim_{\varepsilon\to+0}\frac{1}{\varepsilon}[\sum_{k=1}^{n}Z^\dagger(a_1)\cdots Z^\dagger(a_k-\varepsilon)\cdots Z^\dagger(a_n)$$

$$-\sum_{k=1}^{n}Z^\dagger(a_1)\cdots Z^\dagger(a_k)\cdots Z^\dagger(a_n)]|0>$$

※

$$=\lim_{\varepsilon\to+0}\frac{1}{\varepsilon}\int_{-\infty}^{\infty}dt\,[Z^\dagger(t)Z(t+\varepsilon)$$

$$-Z^\dagger(t)Z(t+0)]\underbrace{Z^\dagger(a_1)\cdots Z^\dagger(a_n)|0>}_{|\nu>}$$

$$=\lim_{\varepsilon\to+0}\frac{1}{\varepsilon}\int_{-\infty}^{\infty}dt\,Z^\dagger(t)[Z(t+\varepsilon)-Z(t)]|\nu>$$

$$=\int_{-\infty}^{\infty}dt\,Z^\dagger(t)\frac{d}{dt}Z(t)|\nu>$$

↓

$$i\hbar\int_{-\infty}^{\infty}dt\,Z^\dagger(t)\frac{d}{dt}Z(t)|\Phi>=A\int_{-\infty}^{\infty}dt\,Z^\dagger(t)Z(t)|\Phi>$$

抽象的記号法で書かれた宇田方程式

$$\boxed{\int_{-\infty}^{\infty}dt\,Z^\dagger(t)\left(-i\hbar\frac{d}{dt}+A\right)Z(t)|\Phi>=0}$$