Eigenfunction of Continuous State

$$\left.\begin{aligned}\psi_1 &= -i F_K P_{K+1}^{u} \\ \psi_2 &= -i F_K P_{K+1}^{u+1} \\ \psi_3 &= (k+u+1) G_K P_K^{u} \\ \psi_4 &= (-k+u) G_K P_K^{u+1}\end{aligned}\right\} \qquad \left.\begin{aligned}\psi_1 &= -i(k+u) F_{-k-1} P_{k-1}^{u} \\ \psi_2 &= -i(-k+u+1) F_{-k-1} P_{k-1}^{u+1} \\ \psi_3 &= G_{-k-1} P_K^{u} \\ \psi_4 &= G_{-k-1} P_K^{u+1}\end{aligned}\right\}$$

$$\mathfrak{F}_K = A F_K - B G_K \qquad \mathfrak{G}_K = A F_K + B G_K$$

$$\mathfrak{F}_K = \int e^{r\zeta} v_1(\zeta)\, d\zeta \qquad \mathfrak{G}_K = \int e^{r\zeta} v_2(\zeta)\, d\zeta$$

$$\mathfrak{F}_K = S \int_{C'} e^{r\zeta} \int_{-ia}^{+ia} (t-ia)^{-(\lambda+ib+2)} (t+ia)^{-(\lambda-ib+1)} \times (t-\zeta)^{\lambda+1}\, dt\, d\zeta$$

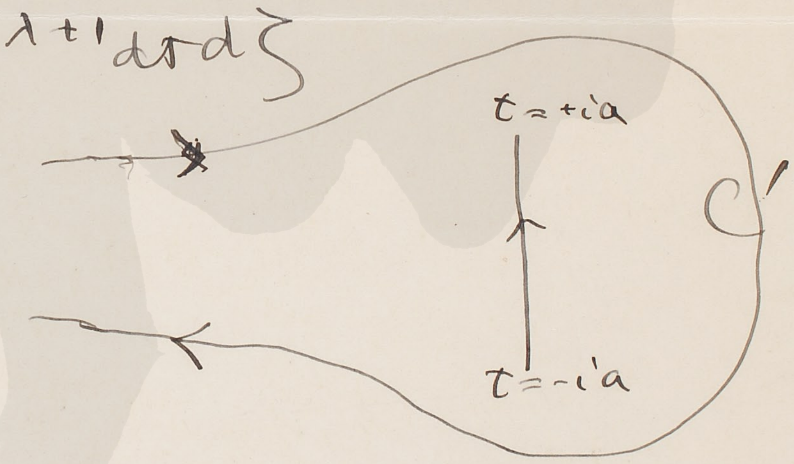
$$\mathfrak{G}_K = T \int_{C'} e^{r\zeta} \int_{-ia}^{+ia} (t-ia)^{-(\lambda+ib+1)} (t+ia)^{-(\lambda-ib+2)} \times (t-\zeta)^{\lambda+1}\, dt\, d\zeta$$

$$\lambda = -1 - \sqrt{(k+1)^2 - \gamma^2}$$

$$AB = ia$$

$$\frac{\gamma}{2}\left(\frac{A}{B} - \frac{B}{A}\right) = -ib$$

$$\frac{\gamma}{2}\left(\frac{A}{B} + \frac{B}{A}\right) = -ic$$

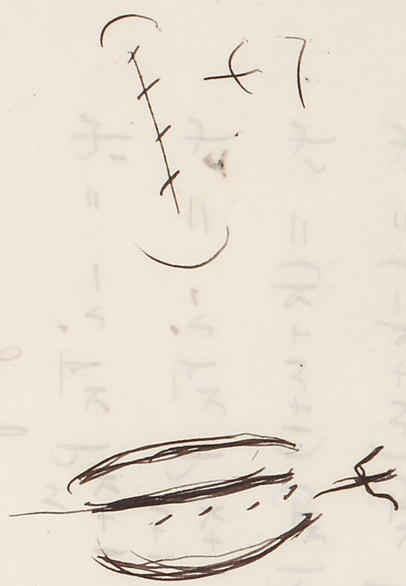


asympotic expression

$$\mathfrak{G}_K = i^{s+1} [(k-s) - i(b+c)] e^{-\frac{3\pi b}{2}} (2a)^{s+1} \Gamma(s+ib+1) \times e^{-iar} r^{-(ib+1)} \left(1 + O\left(\frac{1}{r}\right)\right)$$

$$F_K = \frac{1}{A} \sqrt{(k-s)^2 + (b+c)^2}\, |\Gamma(s+ib+1)| e^{-\frac{3\pi b}{2}} (2a)^{s+1} \times \frac{1}{r} \cos(ar + b\log r + \delta_a)$$

$$G_K = \frac{1}{|B|} \sqrt{\quad\text{''}\quad} \times \text{''} \times \frac{1}{r} \cos(ar + b\log r + \delta'_a)$$



$$\int \sum \psi_r(E,k,u)\,\psi_r^*(E'k'u')\,dv$$

$$= \begin{cases} \delta_{EE'}\,\delta_{kk'}\,\delta_{uu'} & \text{for discrete states} \\ \frac{1}{h}\,\delta(E-E')\,\delta_{kk'}\,\delta_{uu'} & \text{for continuous state} \end{cases}$$

$$\int_0^{\pi}\int_0^{2\pi} P_k^u P_k^{u*} \sin\theta\, d\theta\, d\phi = \frac{4\pi}{2k+1}(k+u)!\,(k-u)!$$

$$\therefore\ 4\pi(k+u+1)!\,(k-u)!\int_0^{\infty}\{F_k(E)F_k^*(E') + G_k(E)G_k^*(E')\}r^2dr$$

$$= \frac{1}{h}\,\delta(E-E')$$

$$\zeta(E,k) = \left(\frac{2\pi E}{hc^2a}\right)^{\frac{1}{2}} \frac{A|B|}{A^2+|B|^2}\,K^{-1}$$

$$K = \frac{1}{2}\sqrt{(k-s)^2+(b+c)^2}\,|\Gamma(s+ib+1)|\,e^{-\frac{3\pi b}{2}}(2a)^{s+1}$$

$$\zeta(k,u) = \sqrt{4\pi(k+u+1)!\,(k-u)!}$$

$$P(t) = \sum_{k'u'}\left(\frac{2\pi}{h}\right)^2 \left|\left(E'k'u'\right|_{eA_0+e\vec{\alpha}\vec{A}}\left|E''k''u''\right)\right|^2 t,$$