

宇田雄一「古典物理学」

【1d1】とは【1d1a】and【1d1b】のことだ。

【1d1a】 $Qm(2,1) = -Z_0 - am(1,1)$

【1d1b】 $\exists t_0 \in \mathbb{R}; \exists \theta_0 \in \mathbb{R}(\mathbb{Z});$ 【1d1b1】and

$$[\forall t \in \mathbb{R}; \forall n \in \mathbb{Z}; -t_0 \leq t - 2nt_0 \leq 0 \Rightarrow \text{【1d1b2】}]$$

$$\text{and } [\forall t \in \mathbb{R}; \forall n \in \mathbb{Z}; 0 \leq t - 2nt_0 \leq t_0 \Rightarrow \text{【1d1b3】}]$$

$$\text{【1d1b1】 } t_0 = \frac{\sqrt{\alpha'}}{-\alpha E} + \frac{\beta}{\alpha \sqrt{\alpha}} \cosh^{-1} \left(\frac{-\alpha' \beta' / A}{\sqrt{\beta'^2 - \alpha' c}} \right) \text{ and } \theta_0(0) = 0$$

【1d1b2】 $\exists z \in \mathbb{R}; z = r(t) - Qm(2,1)/E$ and

$$t = 2nt_0 - \frac{1}{\alpha} \sqrt{\alpha z^2 + 2\beta z + c} - \frac{\beta}{\alpha \sqrt{\alpha}} \cosh^{-1} \left(\frac{-\alpha z - \beta}{\sqrt{\beta^2 - \alpha c}} \right)$$

$$\text{and } \theta(t) = \theta_0(n) - \frac{h}{\sqrt{\alpha'}} \cosh^{-1} \left(\frac{\alpha' / r(t) + \beta'}{\sqrt{\beta'^2 - \alpha' A}} \right)$$

【1d1b3】 $\exists z \in \mathbb{R}; z = r(t) - Qm(2,1)/E$ and

$$t = 2nt_0 + \frac{1}{\alpha} \sqrt{\alpha z^2 + 2\beta z + c} + \frac{\beta}{\alpha \sqrt{\alpha}} \cosh^{-1} \left(\frac{-\alpha z - \beta}{\sqrt{\beta^2 - \alpha c}} \right)$$

$$\text{and } \theta(t) = \theta_0(n) + \frac{h}{\sqrt{\alpha'}} \cosh^{-1} \left(\frac{\alpha' / r(t) + \beta'}{\sqrt{\beta'^2 - \alpha' A}} \right)$$

【1d2】とは【1d2a】and【1d2b】のことだ。

【1d2a】 $Qm(2,1) = -Z_0 - am(1,1)$

【1d2b】 $\exists t_0 \in \mathbb{R}; \exists \theta_0 \in \mathbb{R}(\mathbb{Z});$ 【1d2b1】and

$$[\forall t \in \mathbb{R}; \forall n \in \mathbb{Z}; -t_0 \leq t - 2nt_0 \leq 0 \Rightarrow \text{【1d2b2】}]$$

$$\text{and } [\forall t \in \mathbb{R}; \forall n \in \mathbb{Z}; 0 \leq t - 2nt_0 \leq t_0 \Rightarrow \text{【1d2b3】}]$$

$$\text{【1d2b1】 } t_0 = -\frac{\sqrt{\alpha'}}{6\beta^2 E} \left(\frac{\alpha'}{E^2} - 3c \right) \text{ and } \theta_0(0) = 0$$

【1d2b2】 $\exists z \in \mathbb{R}; z = r(t) - Qm(2,1)/E$ and

$$t = 2nt_0 - \frac{1}{3\beta^2} (\beta z - c) \sqrt{2\beta z + c}$$

$$\text{and } \theta(t) = \theta_0(n) - \frac{h}{\sqrt{\alpha'}} \cosh^{-1} \left(\frac{\alpha' / r(t) + \beta'}{\sqrt{\beta'^2 - \alpha' A}} \right)$$