Ideals Inescapable

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$\mathbb{C}\otimes\mathbb{O}$

$$a_0, a_1 \in \mathbb{R} \qquad a \equiv a_0 + ia_1 \in \mathbb{C}$$

$$ii = -1 \qquad * : a \mapsto a^* = a_0 - ia_1$$

$$f_0, f_1, \ldots f_7 \in \mathbb{C}$$

$$f \equiv f_0e_0 + f_1e_1 \cdots + f_7e_7 \in \mathbb{C}\otimes\mathbb{O}$$

$$ie_j = e_ji \qquad \forall j = 0\ldots7$$

$$e_0 \equiv 1, \qquad e_1e_1 = -1, \;\; \ldots \;\; e_7e_7 = -1$$

$$e_je_k = -e_ke_j \qquad \forall j,k = 1\ldots7, \;\; j \neq k$$

$$e_je_k = e_l \;\; \Rightarrow \;\; e_{j+1}e_{k+1} = e_{l+1} \qquad \forall j,k = 1\ldots7$$

$$e_je_k = e_l \;\; \Rightarrow \;\; e_{2j}e_{2k} = e_{2l} \qquad \forall j,k = 1\ldots7$$

$$e_1e_2 = e_4$$

$$f^\dagger \equiv f_0^*e_0 - f_1^*e_1 - f_2^*e_2 \cdots - f_7^*e_7$$

$\exists \;\; \mathbb{C}\otimes\overleftarrow{\mathbb{O}}$

$$h_1 \in \mathbb{C}\otimes\mathbb{O}$$

$$h_1(\;\;) : \mathbb{C}\otimes\mathbb{O} \to \mathbb{C}\otimes\mathbb{O}$$

$$h_1(\;\;) : f \mapsto h_1f \in \mathbb{C}\otimes\mathbb{O}$$

$$h_1, h_2 \in \mathbb{C}\otimes\mathbb{O}$$

$$h_2\left(h_1\left(\;\;\right)\right) : \mathbb{C}\otimes\mathbb{O} \to \mathbb{C}\otimes\mathbb{O}$$

$$h_2\left(h_1\left(\;\;\right)\right) : f \mapsto h_2(h_1f) \in \mathbb{C}\otimes\mathbb{O}$$

$$h_1, h_2, h_3 \in \mathbb{C}\otimes\mathbb{O}$$

$$h_3\left(h_2\left(h_1\left(\;\;\right)\right)\right) : \mathbb{C}\otimes\mathbb{O} \to \mathbb{C}\otimes\mathbb{O}$$

$$h_3\left(h_2\left(h_1\left(\;\;\right)\right)\right) : f \mapsto h_3\left(h_2\left(h_1f\right)\right) \in \mathbb{C}\otimes\mathbb{O}$$

$$\mathbb{C}\otimes\overleftarrow{\mathbb{O}} \equiv \Big\{ \;\; m = \sum\nolimits_u h_u(\;\;) + \sum\nolimits_{v,w} h_w\left(h_v\left(\;\;\right)\right)$$

$$+ \sum\nolimits_{x,y,z} h_z\left(h_y\left(h_x\left(\;\;\right)\right)\right) \;\; \Big\} \sim Cl_6(\mathbb{C})$$

$$m, n, p \in \mathbb{C}\otimes\overleftarrow{\mathbb{O}}$$

$$nm = p \;\; \Leftrightarrow \;\; n(m(f)) = p(f) \qquad \forall f \in \mathbb{C}\otimes\mathbb{O}$$

$\exists \;\; \omega\omega^*$

$$\alpha_1 \equiv \frac{-e_5 + ie_4}{2} \qquad \alpha_2 \equiv \frac{-e_3 + ie_1}{2} \qquad \alpha_3 \equiv \frac{-e_6 + ie_2}{2}$$

$$\omega \equiv \alpha_1\left(\alpha_2\left(\alpha_3\left(\;\;\right)\right)\right) \in \mathbb{C}\otimes\overleftarrow{\mathbb{O}}$$

$$\omega\omega = 0$$

$$\omega\omega^*\omega\omega^* = \omega\omega^*$$

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$\exists\ I$

$$I \equiv \left\{\ s \in \mathbb{C} \otimes \overleftarrow{\mathbb{O}}\ \mid\ s = s\omega\omega^*\ \right\} \subset \mathbb{C} \otimes \overleftarrow{\mathbb{O}}$$

$$\nu \equiv \omega\omega^* \qquad e^- \equiv \alpha_1\alpha_2\alpha_3\omega^*\omega = \omega \equiv e^{+*}$$

$$d^R \equiv -\alpha_1\omega^*\omega \qquad d^G \equiv -\alpha_2\omega^*\omega \qquad d^B \equiv -\alpha_3\omega^*\omega$$

$$u^R \equiv \alpha_2^*\alpha_3^*\omega\omega^* \qquad u^G \equiv \alpha_3^*\alpha_1^*\omega\omega^* \qquad u^B \equiv \alpha_1^*\alpha_2^*\omega\omega^*$$

$$I = \left\{\ \mathcal{V}\nu + \bar{\mathcal{D}}^R d^{R^*} + \bar{\mathcal{D}}^G d^{G^*} + \bar{\mathcal{D}}^B d^{B^*}\right.$$

$$\left. + \mathcal{U}^R u^R + \mathcal{U}^G u^G + \mathcal{U}^B u^B + \mathcal{E}^+ e^+\ \right\},$$

$$\mathcal{V},\ \bar{\mathcal{D}}^R,\ \bar{\mathcal{D}}^G,\ \bar{\mathcal{D}}^B,\ \mathcal{U}^R,\ \mathcal{U}^G,\ \mathcal{U}^B,\ \mathcal{E}^+ \in \mathbb{C}$$

$$I^* \equiv \left\{\ s \in \mathbb{C} \otimes \overleftarrow{\mathbb{O}}\ \mid\ s = s\omega^*\omega\ \right\} \subset \mathbb{C} \otimes \overleftarrow{\mathbb{O}}$$

$$I^* = \left\{\ \bar{\mathcal{V}}\nu^* + \mathcal{D}^R d^R + \mathcal{D}^G d^G + \mathcal{D}^B d^B\right.$$

$$\left. + \bar{\mathcal{U}}^R u^{R^*} + \bar{\mathcal{U}}^G u^{G^*} + \bar{\mathcal{U}}^B u^{B^*} + \mathcal{E}^- e^-\ \right\},$$

$$\bar{\mathcal{V}},\ \mathcal{D}^R,\ \mathcal{D}^G,\ \mathcal{D}^B,\ \bar{\mathcal{U}}^R,\ \bar{\mathcal{U}}^G,\ \bar{\mathcal{U}}^B,\ \mathcal{E}^- \in \mathbb{C}$$

$\mathcal{L}\left(U_{em}\left(1\right)\right) I\ \ \&\ \ \mathcal{L}\left(SU_c\left(3\right)\right) I$

$$b \equiv b_1\alpha_1 + b_2\alpha_2 + b_3\alpha_3$$

$$b_1,\ b_2,\ b_3 \in \mathbb{C} \qquad b^\dagger b \in \mathbb{C} \otimes \overleftarrow{\mathbb{O}}$$

$$b^\dagger b = \left({b_1}^* b_1 + {b_2}^* b_2 + {b_3}^* b_3\right)\mathcal{E}$$

$$-\frac{1}{2}\left({b_1}^* b_2 + {b_2}^* b_1\right)\Lambda_1 + \frac{i}{2}\left({b_1}^* b_2 - {b_2}^* b_1\right)\Lambda_2$$

$$+\frac{1}{2}\left({b_2}^* b_2 - {b_1}^* b_1\right)\Lambda_3 - \frac{1}{2}\left({b_3}^* b_1 + {b_1}^* b_3\right)\Lambda_4$$

$$+\frac{i}{2}\left({b_1}^* b_3 - {b_3}^* b_1\right)\Lambda_5 - \frac{1}{2}\left({b_2}^* b_3 + {b_3}^* b_2\right)\Lambda_6$$

$$+\frac{i}{2}\left({b_2}^* b_3 - {b_3}^* b_2\right)\Lambda_7 - \frac{1}{2\sqrt{3}}\left({b_1}^* b_1 + {b_2}^* b_2 - 2{b_3}^* b_3\right)\Lambda_8$$

$$\overleftarrow{e_{jk}} f \equiv e_j\left(e_k\left(f\right)\right)$$

$$\mathcal{E} \equiv \#/3 \equiv \frac{1}{2} - \frac{i}{6}\left(\overleftarrow{e_{13}} + \overleftarrow{e_{26}} + \overleftarrow{e_{45}}\right)$$

$$\Lambda_1 \equiv \frac{i}{2}(\overleftarrow{e_{15}} - \overleftarrow{e_{34}}) \qquad \Lambda_2 \equiv \frac{i}{2}(-\overleftarrow{e_{14}} - \overleftarrow{e_{35}})$$

$$\Lambda_3 \equiv \frac{i}{2}(-\overleftarrow{e_{13}} + \overleftarrow{e_{45}}) \qquad \Lambda_4 \equiv \frac{i}{2}(\overleftarrow{e_{25}} + \overleftarrow{e_{46}})$$

$$\Lambda_5 \equiv \frac{i}{2}(-\overleftarrow{e_{24}} + \overleftarrow{e_{56}}) \qquad \Lambda_6 \equiv \frac{i}{2}(\overleftarrow{e_{16}} + \overleftarrow{e_{23}})$$

$$\Lambda_7 \equiv \frac{i}{2}(\overleftarrow{e_{12}} + \overleftarrow{e_{36}}) \qquad \Lambda_8 \equiv \frac{i}{2\sqrt{3}}(\overleftarrow{e_{13}} + \overleftarrow{e_{45}} - 2\overleftarrow{e_{26}})$$

$$I\ \mathcal{L}\left(SU_L\left(2\right)\right) \to I^* \ldots$$