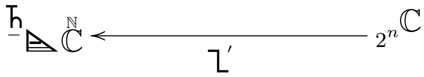


$$\hbar\triangle\overline{\mathbb{C}}^{\mathbb{N}} \ni \daleth^{J} = \bigwedge_{j\in J} \daleth^{j} \quad \text{dual standard basis}$$

$$\daleth^{I} \bowtie \daleth^{J} = \overset{*}{\daleth}^{I}\ \mathring{\eta}\ \daleth^{J} = \det \daleth^{i} \bowtie \daleth^{j} = \det {}_{i}\eta^{j} = {}_{I}\eta^{J} = {}_{I}\mathring{\eta}^{J}$$

$$\bowtie {}_{I}\daleth = \daleth^{I}\ {}_{I}\eta^{I}$$

$$\daleth^{I} = (\bowtie {}_{I}\daleth)\ {}_{I}\eta^{I}$$

$$\ast\daleth^{I} = \daleth^{N\llcorner I}\ \overline{I > \overset{\circ}{N}\llcorner I}\ {}_{I}\eta^{I}$$

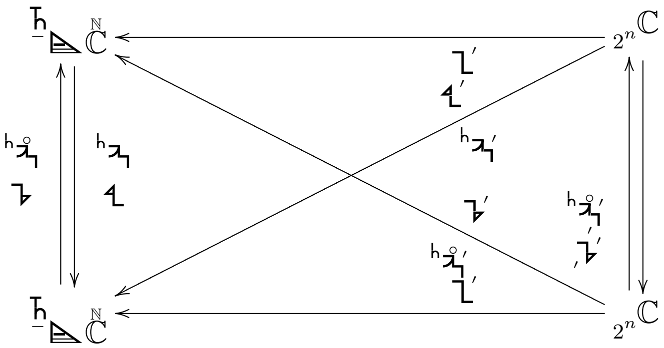
$${}_{,}\daleth = {}_{,}\daleth\ \underbrace{\daleth'{}_{,}\daleth}$$

$${}_{M}\daleth\ \daleth^{N} = \det\left({}_{\mu}\daleth\daleth^{\nu}\right) = \det {}_{\mu}\delta^{\nu} = {}_{M}\delta^{N}$$

$$\daleth_{,} = {}_{,}\daleth\ \underbrace{\daleth'\daleth_{,}}$$

$$\overset{*}{\daleth}^{I}\ \daleth^{J} = \det \overset{*}{\daleth}^{i}\ \daleth^{j} = \det {}_{i}\delta^{j} = {}_{I}\delta^{J} = {}_{I}\daleth\ \daleth^{J}$$

$$\overset{*}{\daleth}^{I} = {}_{I}\daleth$$



$$\overset{*}{\daleth}^{I} \underset{\hbar}{\bowtie} \daleth^{J} = \begin{cases} \overset{*}{\daleth}^{I}\,{}^{\hbar}\daleth\,\daleth^{J} & = {}^{\hbar}\daleth^{IJ} \\ \overset{*}{\daleth}^{I}\,\daleth_{\hbar}\,\daleth^{J} & = {}_{I}\daleth\,\daleth_{\hbar}\,\daleth^{J} = \det \daleth^{i} \underset{\hbar}{\bowtie} \daleth^{j} = \det {}_{I}\daleth^{J}_{\hbar} = {}_{I}\daleth^{J}_{\hbar} \end{cases}$$

$$\overset{z}{\bowtie}\ {}_{J}\daleth = \sum_{|I|=|J|} \daleth^{I}\ {}^{z}_{I}\daleth^{J}$$

$$\daleth^{J} = \sum_{|I|=|J|} \left(\overset{z}{\bowtie}{}_{I}\daleth\right)\ {}_{I}\daleth^{J}_{z}$$

$$ {}_{M}\daleth \sum_{I} \daleth^{I} \; {}_{I}\tilde{\tilde{\Lambda}}^{J} = \sum_{I} {}_{M}\delta^{I} \; {}_{I}\tilde{\tilde{\Lambda}}^{J} = {}_{M}\tilde{\tilde{\Lambda}}^{J} = {}_{M}\daleth \; \overset{z}{\ltimes} \; {}_{J}\daleth $$

$$ {}_{M}\daleth \; \daleth^{J} = {}_{M}\delta^{J} = \det {}_{M}\left(\beth_{z}\, {}^{z}\Lambda \right)^{J} = \sum_{|I| = |J|} {}_{M}\beth_{z}^{I} \; {}^{z}_{I}\Lambda^{J} = \sum_{I} \left({}_{M}\daleth \ltimes {}_{I}\daleth \right) {}^{z}_{I}\Lambda^{J} $$

$$ \overset{z}{\ltimes} \; {}_{I}\beth = \Lambda^{I} \; {}_{I}\eta^{I} $$

$$ \ltimes \Lambda^{I} = \left({}_{I}\beth \right) \; {}_{I}\eta^{I} $$

$$ \bar{h} \, \bar{\triangle} \, \mathbb{C}^{\mathbb{N}} \ni \begin{cases} {}^{h}\gimel^{J} & = {}^{h}\gimel_{g}\daleth \\ \Lambda^{J} & = {}_{j \in J}\ltimes \Lambda^{j} = \Lambda \daleth^{J} \end{cases} \text{ dual ONBasis} $$

$$ \begin{cases} {}^{h}\gimel & = {}^{h}\gimel^{I} \; {}_{I}\daleth \\ \Lambda & = \Lambda^{I} \; {}_{I}\daleth \end{cases} $$

$$ \begin{cases} {}^{h}\gimel^{I} \underset{h}{\ltimes} {}^{h}\gimel^{J} = {}^{h}\overset{*}{\gimel}{}^{I} \, {}^{h}\gimel \, {}^{h}\gimel^{J} = {}^{h}\overset{*}{\gimel}{}^{I} \underbrace{{}^{h}\bar{\gimel}^{*} \mathring{\eta} \, {}^{h}\mathring{\gimel}} \, {}^{h}\gimel^{J} = \underbrace{{}^{h}\overset{*}{\gimel}{}^{I} \, {}^{h}\mathring{\gimel}} \mathring{\eta} \underbrace{{}^{h}\gimel^{J} \, {}^{h}\mathring{\gimel}} & = \underbrace{{}^{h}\overset{*}{\gimel}\daleth^{I}} \ldots \\ \Lambda^{I} \underset{h}{\ltimes} \Lambda^{J} = \det \overset{*}{\Lambda}{}^{i} \left(\overset{*}{\beth} \eta \beth \right) \Lambda^{j} = \det \left(\beth \overset{*}{\Lambda}{}^{i} \right) \eta \left(\beth \Lambda^{j} \right) = \det {}_{i}\overset{*}{\daleth} \eta \daleth^{j} = \overset{*}{\Lambda}{}^{I} \beth_{h} \Lambda^{J} = \overset{*}{\Lambda}{}^{I} \underbrace{\overset{*}{\beth} \mathring{\eta} \beth} \Lambda^{J} = \underbrace{\beth \overset{*}{\Lambda}{}^{I}} \mathring{\eta} \underbrace{\beth \Lambda^{J}} & = \underbrace{\Lambda \overset{*}{\daleth}{}^{I}} \ldots \end{cases} $$

$$ \underset{z}{\ast} \Lambda^{I} = \Lambda^{N \llcorner I} \; \overline{I > \underset{\circ}{N} \llcorner I} \; {}_{I}\eta^{I} $$

$$ \underset{z}{\ast} \daleth^{J} = \sum_{|I| = |J|} \daleth^{N \llcorner I} \; \overline{I > \underset{\circ}{N} \llcorner I} \; {}_{I}\beth_{z}^{J} \left({}_{N}\eta^{N} / {}_{N}\beth_{z}^{N} \right)^{1/2} $$

$$ \Lambda^{N} = c \; \daleth^{N} $$

$$ {}_{N}\eta^{N} = \Lambda^{N} \underset{z}{\ltimes} \Lambda^{N} = c^{2} \; \daleth^{N} \underset{z}{\ltimes} \daleth^{N} = c^{2} \; {}_{N}\beth_{z}^{N} \implies \text{LHS} = \sum_{I} \underbrace{{}_{I}\daleth \vDash \Lambda^{N}} \; {}_{I}\beth_{z}^{J} = \sum_{I} {}_{I}\daleth \vDash \daleth^{N} \left({}_{N}\eta^{N} / {}_{N}\beth_{z}^{N} \right)^{1/2} {}_{I}\beth_{z}^{J} = \text{RH}\ldots $$

$$ \psi = \begin{cases} {}^{h}\mathring{\gimel}_{,} \underbrace{{}^{h}\gimel' \psi_{,}} \\ {}_{,}\beth \underbrace{\Lambda' \psi_{,}} \end{cases} \qquad {}_{I}\delta^{J} = \begin{cases} {}^{h}\mathring{\gimel}_{I} \, {}^{h}\gimel^{J} \\ {}_{I}\beth \Lambda^{J} \end{cases} $$

$$ {}_{,}\Lambda = \begin{cases} {}^{h}\gimel_{,} \underbrace{{}^{h}\mathring{\gimel}' {}_{,}\Lambda} \\ {}_{,}\Lambda \underbrace{\beth' {}_{,}\Lambda} \end{cases} $$

$$ {}_{M}\delta^{N} = \begin{cases} {}^{h}\gimel_{M} \, {}^{h}\mathring{\gimel}^{N} \\ {}_{M}\Lambda \beth^{N} \end{cases} $$

$$ \daleth' \; \psi_{,} = \begin{cases} {}^{h}\mathring{\gimel} \underbrace{{}^{h}\gimel' \psi_{,}} & = {}^{h}\mathring{\gimel}' \underbrace{{}^{h}\gimel_{,}' \psi_{,}} \\ \beth \underbrace{\Lambda' \psi_{,}} & = \beth' \underbrace{{}_{,}\Lambda' \psi_{,}} \end{cases} $$

$$\text{[illegible]}^{J} = \begin{cases} \text{[illegible]}^{J} = \text{[illegible]}^{L}\,\text{[illegible]}_{L}^{J} \\ \text{[illegible]}^{J} = \text{[illegible]}^{L}\,{}_{L}\text{[illegible]}^{J} \end{cases}$$

$$\text{[illegible]}' \;{}_{,}\text{[illegible]} = \begin{cases} \text{[illegible]} = \text{[illegible]}' \\ \text{[illegible]} = \text{[illegible]}' \end{cases}$$

$$\text{[illegible]}^{N} = \begin{cases} \text{[illegible]}^{N} = \text{[illegible]}^{K}\,\text{[illegible]}_{K}^{N} \\ \text{[illegible]}^{N} = \text{[illegible]}^{K}\,{}_{K}\text{[illegible]}^{N} \end{cases}$$

$$\begin{cases} \text{[illegible]}' = \text{[illegible]}' = \text{[illegible]} \\ \text{[illegible]}' = \text{[illegible]}' = \text{[illegible]} \end{cases}$$

$$\begin{cases} \text{[illegible]}^{J} = \text{[illegible]}^{L}\,\text{[illegible]}_{L}^{J} = \text{[illegible]}^{J} \\ \text{[illegible]}^{J} = \text{[illegible]}^{L}\,{}_{L}\text{[illegible]}^{J} = \text{[illegible]}^{J} \end{cases}$$

$$\begin{cases} \text{[illegible]}' = \text{[illegible]}' = \text{[illegible]} \\ \text{[illegible]}' = \text{[illegible]}' = \text{[illegible]} \end{cases}$$

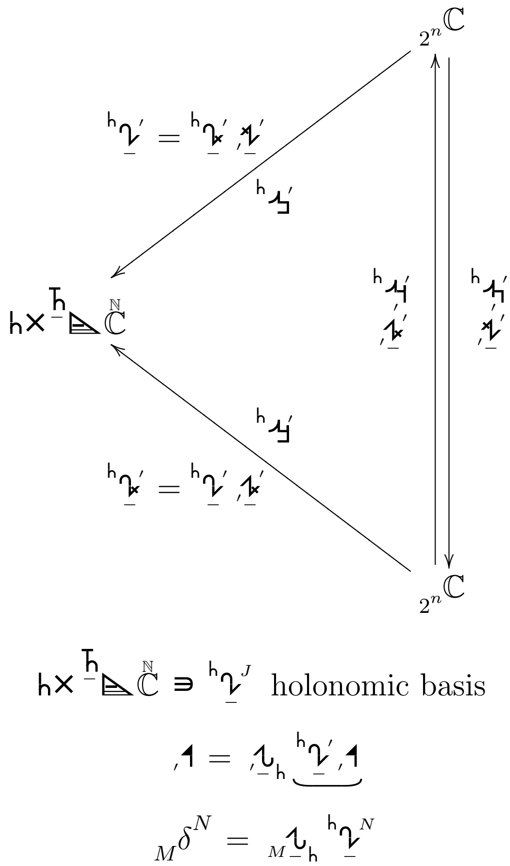
$$\begin{cases} \text{[illegible]}^{N} = \text{[illegible]}^{K}\,\text{[illegible]}_{K}^{N} = \text{[illegible]}^{N} \\ \text{[illegible]}^{N} = \text{[illegible]}\;{}_{K}g^{N} = \text{[illegible]}^{N} \end{cases}$$

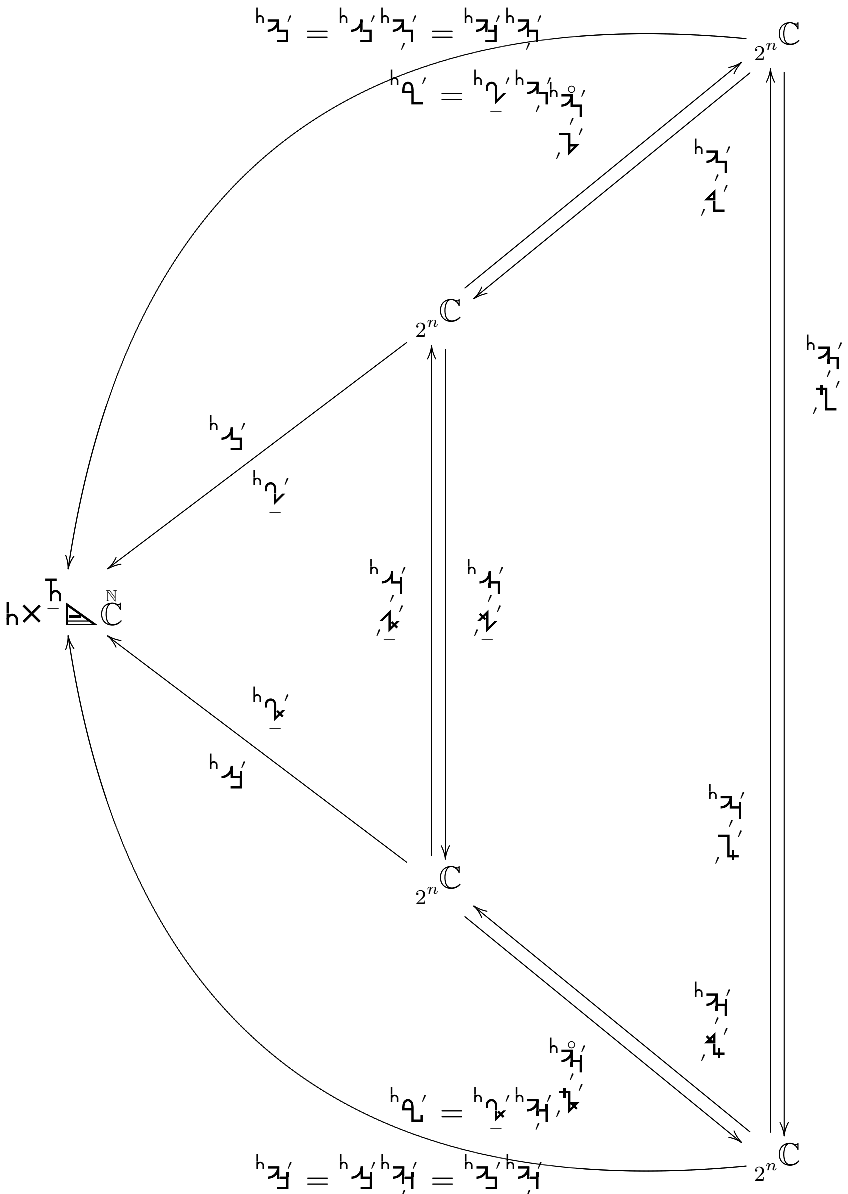
$$\begin{cases} \text{[illegible]} = {}_{,}\text{[illegible]} = \text{[illegible]} \\ {}_{,}\text{[illegible]} = {}_{,}\text{[illegible]} = {}_{,}\text{[illegible]} \end{cases}$$

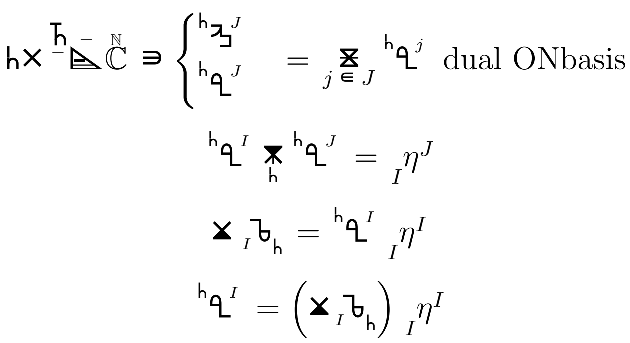
$$\begin{cases} \text{[illegible]}_{M}^{J} = {}_{M}\text{[illegible]}^{J} = \text{[illegible]}_{M}\text{[illegible]}^{J} \\ {}_{M}\text{[illegible]}^{J} = {}_{M}\text{[illegible]}^{J} = {}_{M}\text{[illegible]}^{J} \end{cases}$$

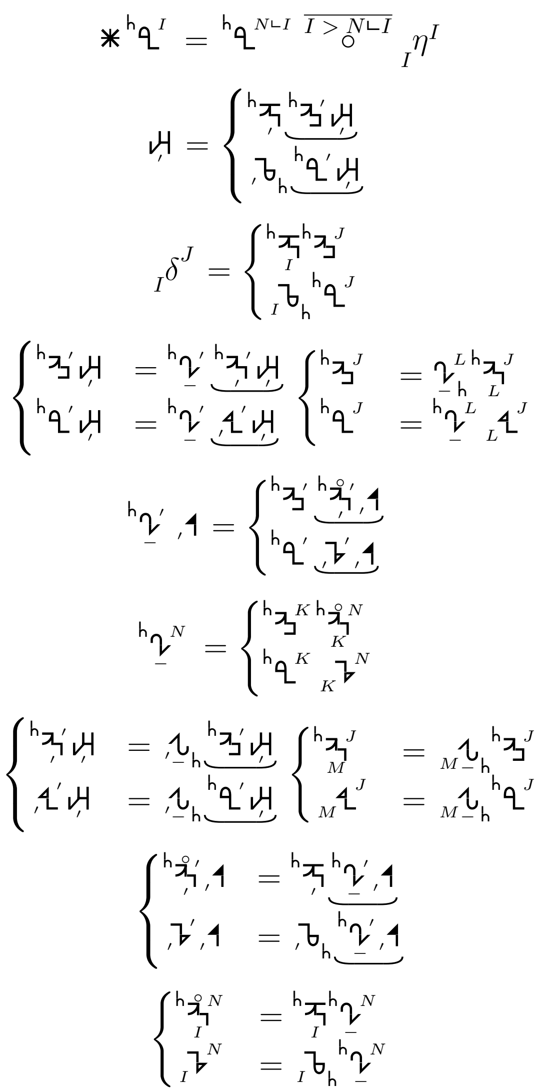
$$\begin{cases} \text{[illegible]} = {}_{,}\text{[illegible]} = \text{[illegible]} \\ {}_{,}\text{[illegible]} = {}_{,}\text{[illegible]} = {}_{,}\text{[illegible]} \end{cases}$$

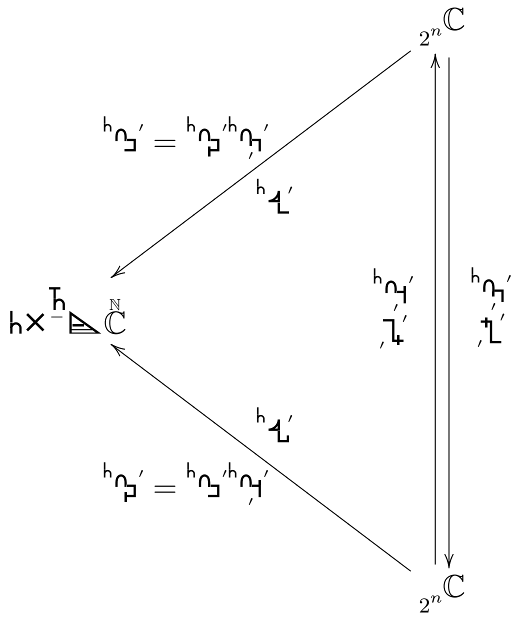
$$\begin{cases} \text{[illegible]}_{I}^{N} = {}_{I}\text{[illegible]}^{N} = \text{[illegible]}_{I}\text{[illegible]}^{N} \\ {}_{I}\text{[illegible]}^{N} = {}_{I}\text{[illegible]}^{N} = {}_{I}\text{[illegible]}^{N} \end{cases}$$


holonomic basis




dual ONbasis




$2^n\mathbb{C}$
$2^n\mathbb{C}$