The Dimensional Potential – A 1-Pager

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Abstract

It will be demonstrated that in the metric picture a potential is additional dimensions with certain properties.

Dimensional Potential Creation

We know from basic quantum theory (e.g. [1]) that many fields and potentials couple into the quantum equations via the so-called weak coupling. Picking the example of the electromagnetic field with the potential A_μ, this would be done as follows:

$$f_{,\alpha} = \partial_\alpha f \rightarrow \left(\partial_\alpha + A_\alpha\right) f \,. \tag{1}$$

This could be interpreted as a coordinate transformation x→X, Y with:

$$\begin{aligned}
& f = f\left[x^\sigma\right] \rightarrow f\left[X^i\left[x^\sigma\right], Y^j\left[x^\sigma\right]\right] = f\left[x^\sigma, Y^j\left[x^\sigma\right]\right] = f_X\left[x^\sigma\right] \cdot f_Y\left[Y^j\left[x^\sigma\right]\right] \\
& \rightarrow \\
& f_{,\alpha} = \frac{\partial f}{\partial\left(X^i\right)} \frac{\partial X^i}{\partial x^\alpha} + \frac{\partial f}{\partial\left(Y^j\right)} \frac{\partial Y^j}{\partial x^\alpha} = \frac{\partial f}{\partial\left(X^i\right)} \frac{\partial X^\sigma}{\partial x^\alpha} + \frac{\partial f}{\partial\left(Y^j\right)} \frac{\partial Y^j}{\partial x^\alpha} \\
& = \frac{\partial f}{\partial\left(X^i\right)} \delta^i_\alpha + \frac{\partial f}{\partial\left(Y^j\right)} \frac{\partial Y^j}{\partial x^\alpha} = \frac{\partial f}{\partial X^\alpha} + \frac{\partial f}{\partial\left(Y^j\right)} \frac{\partial Y^j}{\partial x^\alpha} = f_Y \frac{\partial f_X}{\partial X^\alpha} + f_X \frac{\partial f_Y}{\partial\left(Y^j\right)} \frac{\partial Y^j}{\partial x^\alpha} \\
& \xrightarrow{\frac{\partial f_Y}{\partial\left(Y^j\right)} \frac{\partial Y^j}{\partial x^\alpha} = f_Y A_\alpha} = f_Y \frac{\partial f_X}{\partial X^\alpha} + f_X f_Y A_\alpha = \left(\frac{\partial}{\partial X^\alpha} + A_\alpha\right) f
\end{aligned} \,, \tag{2}$$

with an additional coordinate Y, which agrees with our earlier findings about dimensional mass creation [2 – 6] and the construction of various potentials via additional dimensions [7, 8].

References

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