Charged particle in the electromagnetic field  [ELE13]

Unusual table that requires interpretation

configuration variables
space: primal complex
time: dual complex

\[\begin{align*}
\chi = & 0 \\
\phi = & \partial_t \chi \\
A = & -\nabla \chi \\
U = & q \frac{d\chi}{dt} \\
E = & -\nabla \phi - \partial_t A \\
B = & \nabla \times A \\
F = & q [E + v \times B] \\
\end{align*}\]

\[U(t, x, v) = q \left[ \phi(t, x) - A_h(t, x) v^h(t) \right]\]

\[F_k = \frac{d}{dt} \frac{\partial U}{\partial v^k} - \frac{\partial U}{\partial x^k}\]

\[= q \left[ -\frac{d}{dt} A_k - \left( \partial_h A_k - \partial_k A_h v^h \right) \right]\]

\[= q \left[ -\partial_i A_k - \partial_h A_k v^h - \partial_k \phi + \partial_k A_h v^h \right]\]

\[= q \left[ E_k + (\partial_i A_k - \partial_h A_k) v^h \right]\]

\[= q \left[ E_k + B_{kh} v^h \right]\]

\[F = q [E + v \times B]\]

\(\chi\) gauge function
\(\phi\) electric scalar potential
\(A\) magnetic vector potential
\(E\) electric field strength
\(B\) magnetic flux density
\(U\) generalized potential
\(F\) force


[ELE13]: http://discretephysics.dicar.units.it
compare with Table [FLU10]


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