30. E.R. ν Singular Cut-Off by the Measure $\nu(x, \delta; \Lambda)$

By Hideo YAMAGATA

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§1. **Introduction:** Singular cut-off by using the measure defined in Minkovski space has shown in [3] p. 550. The advantage of this E.R. ν singular cut-off is to admit the expectation value conserving transform of non-local field function (related to Lorentz transform) satisfying the formal Lorentz covariance. In this transform all non-covariant effects are reduced to the change of the definition of singular integral (the change of the measure ν). Since this change of ν corresponds to the change of summation's order, it can be considered as the change (related to non-local structure) by the concepts independent of Lorentz transform. As a possible deformation of this singular cut-off, in §2 we give a sort of three dimensional singular cut-off by using the measure $\nu(x, \delta; \Lambda)$ (a deformed singular cut-off related to the neighbourhood of the set of all space-like position for a point). Since this new singular cut-off has the simple form near the three dimensional one, it seems that this replacement of ν depending on Λ can be understood by non-local mechanism well.

The non-local field function by this singular cut-off satisfies the expectation value conserving Lorentz covariance by the form

$$U(a, \Lambda)(1/2\sigma)\left\{\text{E.R. } B.\,\nu(x, \delta; 1)\iint_{\{x';x'^2=x_0'^2-\vec{x}'^2\leqslant\sigma^2\}} f(x')\,dx_0'\,\varphi(x-\vec{x}')\,d\vec{x}'\right\}U^{-1}(a, \Lambda)$$

$$=(1/2\sigma)\left\{\text{E.R. } B.\,\nu(x, \delta; \Lambda)\iint_{\{x';x'^2=x_0'^2-\vec{x}'^2\leqslant\sigma^2\}} f(x')\,d(\Lambda(x_0'))\,\varphi(\Lambda x+a-\Lambda(\vec{x}'))\,d(\Lambda(\vec{x}'))\right\} \qquad (1)$$

(see §3 Def. 4). $\int d(\Lambda(x_0'))$ is the normalized one satisfying

$$\iint d(\Lambda(x_0')\,d(\Lambda(\vec{x}'))=\int d(\Lambda x').$$

Here, the integral related to this cut-off is by the meaning of [2] p. 377 Def. 1, and E.R. $B\ \nu\int$ is a special form of E.R. $\nu\int$ defined in [2] p. 548 Def. 2. This covariance has the advantage similar to the results in [9] p. 35 which is the origin of the Λ inhomogeneous Lorentz covariance (for three dimensional case) appearing in [2] p. 380 Def. 3. Because we can obtain the various initial conditions related to (a, Λ) (on the various space-like manifolds) from this Lorentz covariant (unified) form (1). Furthermore this measure