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On the Connection Between Analyticity and Lorentz Covariance of Wightman Functions

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Abstract. We prove a conjecture of R. Streater [1] on the finite covariance of functions holomorphic in the extended tube which are Laplace transforms of two tempered distributions with supports in the future and past cones. A new, slightly more general proof is given for a theorem of analytic completion of [1].

A. Notations

1. Scalar product:

$$(z, z') = z^\mu z'_\mu = z^0 z'^0 - z^1 z'^1 - z^2 z'^2 - z^3 z'^3 = z^\mu g_{\mu\nu} z'^\nu$$

for z and z' real or complex four vectors.

2. Future cone:

$$V^+ = \{x : x \in \mathbb{R}^4, (x, x) > 0, x^0 > 0\} = - V^-$$

n-point future cone:

$$V_n^+ = \{x \in \mathbb{R}^{4n} : x = x_1, \ldots, x_n, x_j \in V^+ \ (j = 1, \ldots, n)\} = - V_n^- .$$

3. n-point forward tube:

$$\mathscr{T}_n^+ = \{z \in \mathbb{C}^{4n} : z = x + iy, y \in V_n^+\} = - \mathscr{T}_n^- .$$

4. $L_+^\uparrow$ = connected real Lorentz group. $L_+(\mathbb{C})$ = connected complex Lorentz group.

5. n-point extended tube:

$$\mathscr{T}'_n = \bigcup_{\Lambda \in L_+(\mathbb{C})} \Lambda \mathscr{T}_n^+$$

for $z = z_1, \ldots, z_n \in (\mathbb{C}^4)^n$, $\Lambda z = \Lambda z_1, \ldots, \Lambda z_n$.

6. For $z = z^0, z^1, z^2, z^3 = z^0, \mathrm{z}$, we denote

$$\|z\|^2 = \sum_{\mu=0}^{3} |z^\mu|^2 = |z^0|^2 + |\mathrm{z}|^2$$

for $z = z_1, \ldots, z_n \in (\mathbb{C}^4)^n$, $\|z\|^2 = \sum_{j=1}^{n} \|z_j\|^2$.

7. $\mathscr{J}_n$ = the set of Jost points.