

## Mathematical Physics

# Equivalence of domains for hyperbolic Hubbard-Stratonovich transformations

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We settle a long standing issue concerning the traditional derivation of non-compact non-linear sigma models in the theory of disordered electron systems: the hyperbolic Hubbard-Stratonovich (HS) transformation of Pruisken-Schaefer type. Only recently the validity of such transformations was proved in the case of  $U(p,q)$  (non-compact unitary) and  $O(p,q)$  (non-compact orthogonal) symmetry. In this article we give a proof for general non-compact symmetry groups. Moreover we show that the Pruisken-Schaefer type transformations are related to other variants of the HS transformation by deformation of the domain of integration. In particular we clarify the origin of surprising sign factors which were recently discovered in the case of orthogonal symmetry.

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