

Non-Renormalization of π_1 -Characters under Finite ERG Transformations on Multiply Connected Configuration Spaces

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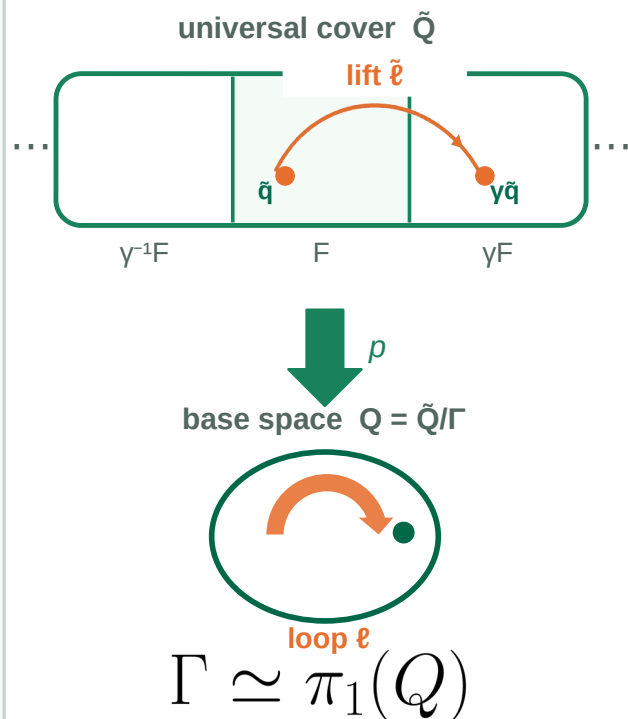
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1 LIFT THE TOPOLOGY



2 CONSTRUCT THE FINITE KERNEL

Dowker covering-space sum

Every lift of the endpoint contributes once.

$$R_{\Lambda, \Lambda'}[\phi, \phi'] = \sum_{\gamma \in \Gamma} D(\gamma) \tilde{R}_{\Lambda, \Lambda'}[\tilde{\phi}, \gamma \tilde{\phi}']$$

$D(\gamma)$: global π_1 -character

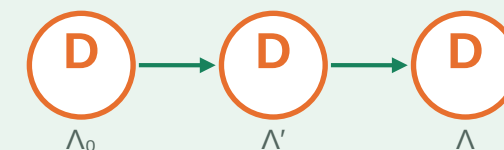
$\tilde{R}$ local finite ERG kernel on the universal cover

D global boundary condition carried by the winding sector

Composition law + simultaneous deck invariance

3 CHARACTER AND LEVEL

One character, two consequences



$$D_{\Lambda, \Lambda_0}(\gamma) = D_{\Lambda', \Lambda_0}(\gamma)$$

non-renormalization

With lift-independent normalization $D(\gamma)=1$:

$$D(\gamma[\ell]) = e^{iI(\ell)} = 1 \implies I(\ell) \in 2\pi\mathbb{Z}$$

level quantization

APPLICATIONS

d-dimensional nonlinear $O(d+2)$ σ model

$$D(n) = e^{i2\pi kn}$$

WZW level k

3d $SU(N)$ Yang-Mills

Chern-Simons level

Explicit universal-cover kernel still faces the Gribov-Singer problem.