

Role of Complexified Supersymmetric Solutions

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Reference:

M.H., arXiv:1710.05010 [hep-th], to be published in PRL

Title is changed by PRL:

Supersymmetric solutions and Borel singularities
for N=2 supersymmetric Chern–Simons theories

In SUSY theories,

\exists configurations

which formally satisfy SUSY conditions: $Q(\text{fields}) = 0$
but are **not on original** path integral contour.

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Let us call them

“Complexified SUSY solutions”

What are their physical roles?

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SUSY solutions?

Our proposal for a part of answers:

What are physical roles of complexified SUSY solutions?

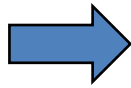
Our proposal for a part of answers:

they provide important information
on large order behavior of perturbative series
in SUSY QFT

Preparation: Borel resummation

Borel transformation:

$$\mathcal{O}(g) \simeq \sum_{l=0}^{\infty} c_l g^{a+l}$$

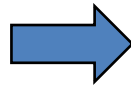


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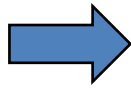
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Locations of **Borel singularities** determine

- Whether or not perturbative series are Borel summable
- factorial divergence of perturbative series:

$$\mathcal{BO}(t) \sim \frac{1}{t-t_0} \quad \rightarrow \quad c_l \sim \frac{l!}{t_0^l}$$

Proposal

Idea:

Conjecture:

Proposal

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Bosonic solution \longleftrightarrow

Fermionic solution \longleftrightarrow

Conjecture:

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Bosonic solution \longleftrightarrow Pole of Borel trans.

Fermionic solution \longleftrightarrow Zero of Borel trans.

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Conjecture:

If there are n_B bosonic & n_F fermionic solutions
with action $S=S_c/g$, then

(in the same topological sector)

$$(\text{Borel trans.}) \supset \prod_{\text{solutions}} \frac{1}{(t - S_c)^{n_B - n_F}}$$

In poster:

We explicitly check

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for SUSY observables in **3d N=2 SUSY Chern-Simons matter theories**

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for SUSY observables in **3d N=2 SUSY Chern-Simons matter theories**

- construct ∞ complexified SUSY sols. in general 3d N=2 SUSY theory on S^3 with Lagrangian
- comparison of their actions & Borel singularities for **“1/k-expansion”** (=perturbative series by inverse CS level)

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Related progress **not** in poster:

- Resurgence [Fujimori-M.H.-Kamata-Misumi-Sakai '18]
- SUSY breaking & complexified SUSY sols. [M.H., work in progress]
- Spectrum of complexified SUSY sols. & effective action [M.H., work in progress]

Thanks!