SUPERSYMMETRIC BOUNDARY CONDITIONS FOR THE END OF SPACETIME: DYNAMICAL COBORDISM IN ADS/CFT

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Based on [JH, Uranga, 2306.07335]

Instituto de Física Teórica
UAM-CSIC

IN THIS TALK.

THE CONCEPT OF BOUNDARIES IN QUANTUM GRAVITY

WHAT ORBIFOLDS ARE AND HOW THEY BREAK SUSY

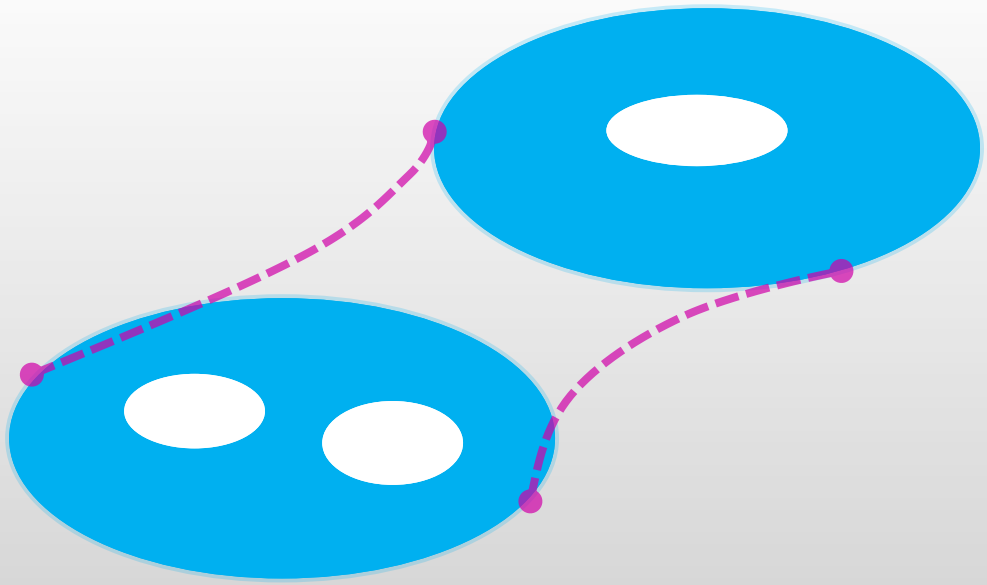
ORBIFOLDS IN END OF THE WORLD BRANES

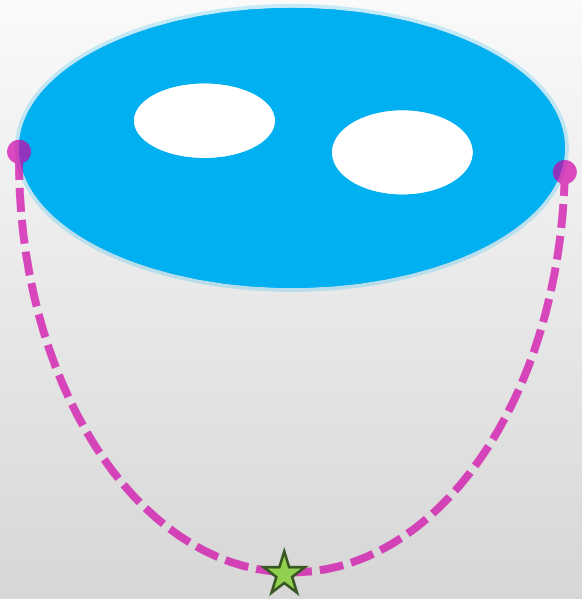
THE CONCEPT OF BOUNDARIES IN QUANTUM GRAVITY

COBORDISM CONJECTURE

[McNamara, Vafa, '19]

The cobordism classes of any solution of Quantum Gravity have to be trivial





COBORDISM IN ADS/CFT

- What is the solution that interpolates between $AdS_5 \times S^5$ and nothing?

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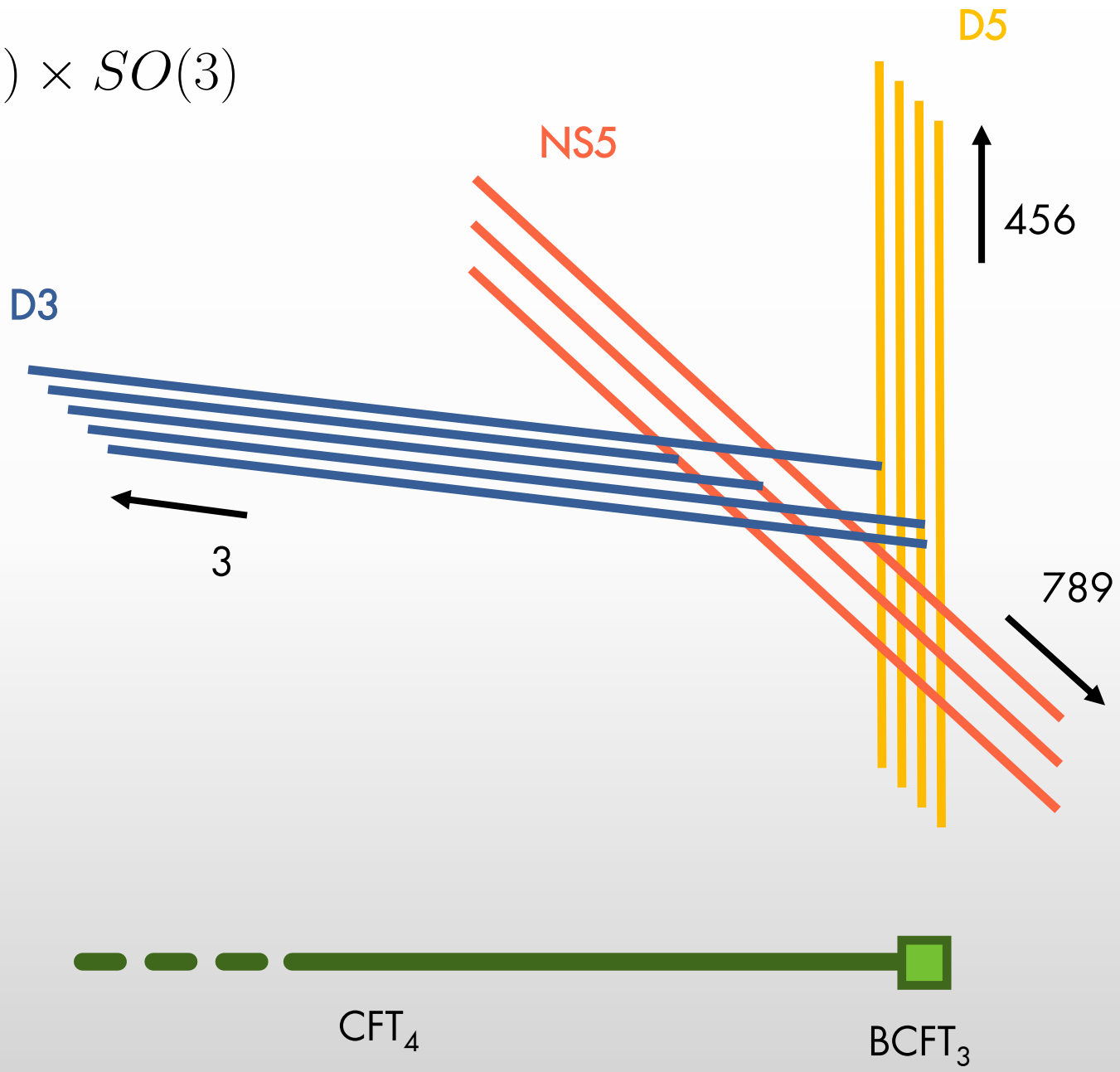
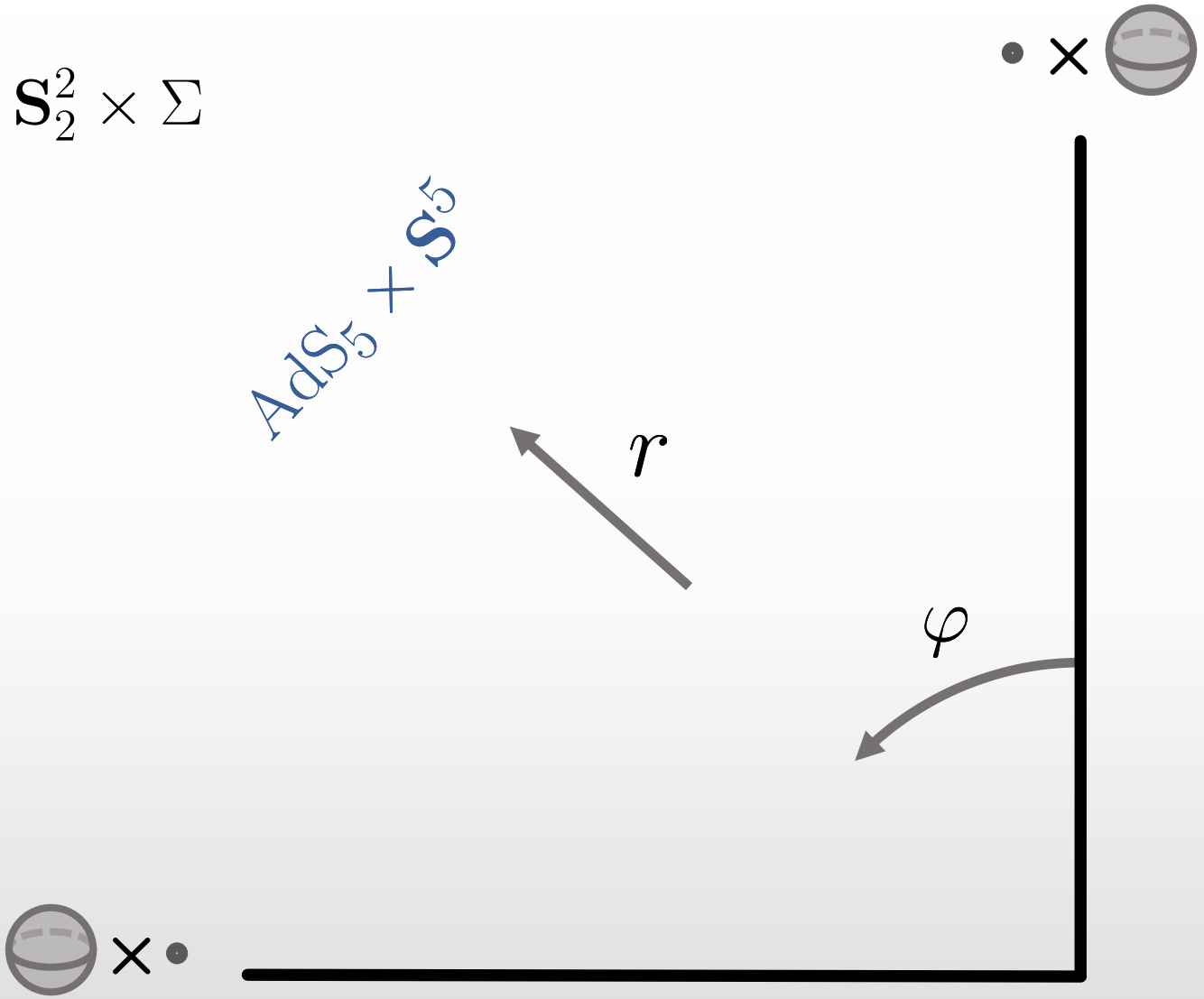
- Supersymmetry preserving cobordism?

  → Our approach

$$SO(2,3) \times SO(3) \times SO(3)$$



$\mathrm{AdS}_4 \times \mathbf{S}^2_1 \times \mathbf{S}^2_2 \times \Sigma$



$$ds^2 = f_4^2 ds^2_{AdS_4} + f_1^2 ds^2_{\mathbf{S}^2_1} + f_2^2 ds^2_{\mathbf{S}^2_2} + 4\rho^2(dr^2 + r^2 d\varphi^2)$$

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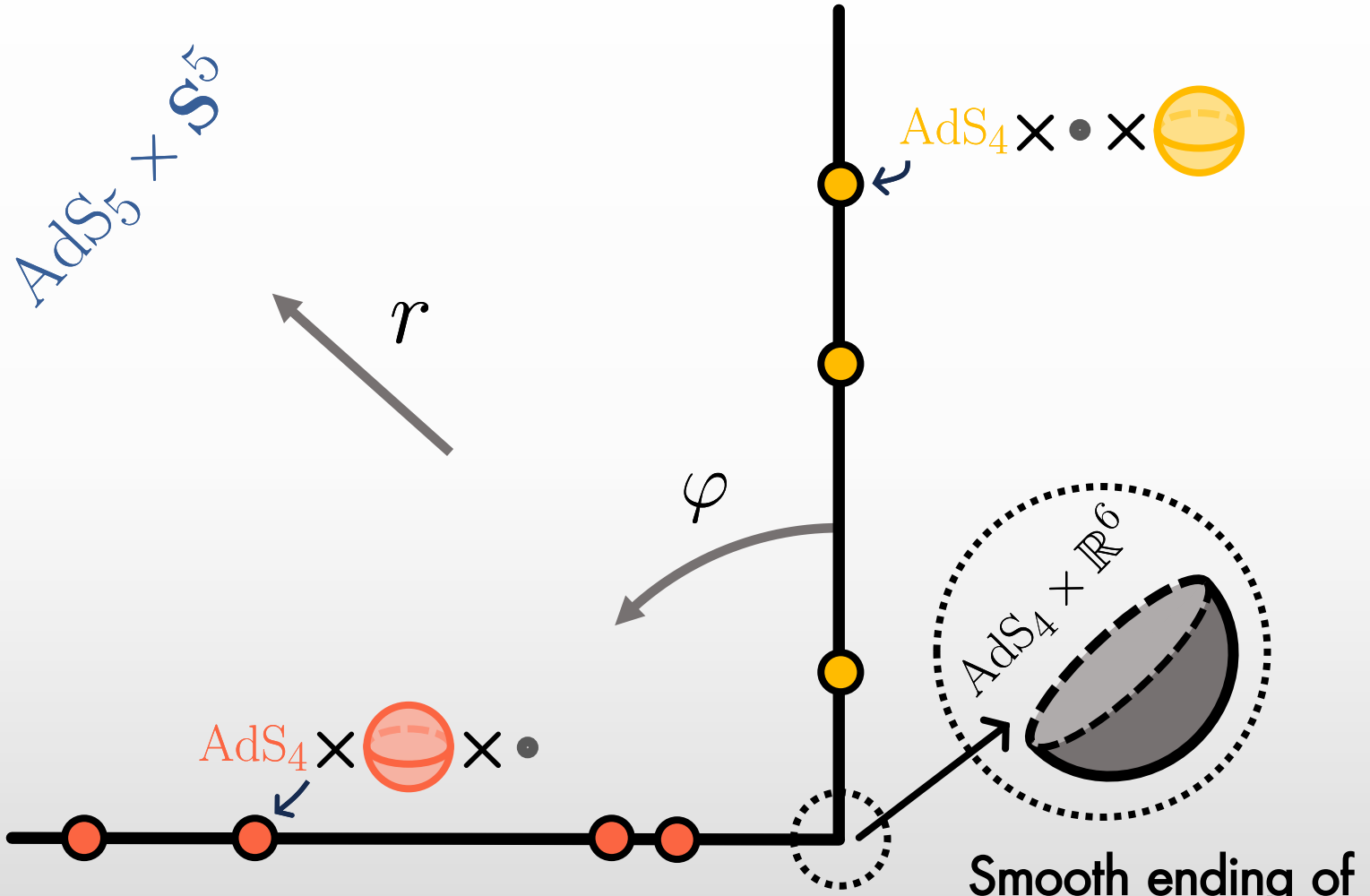
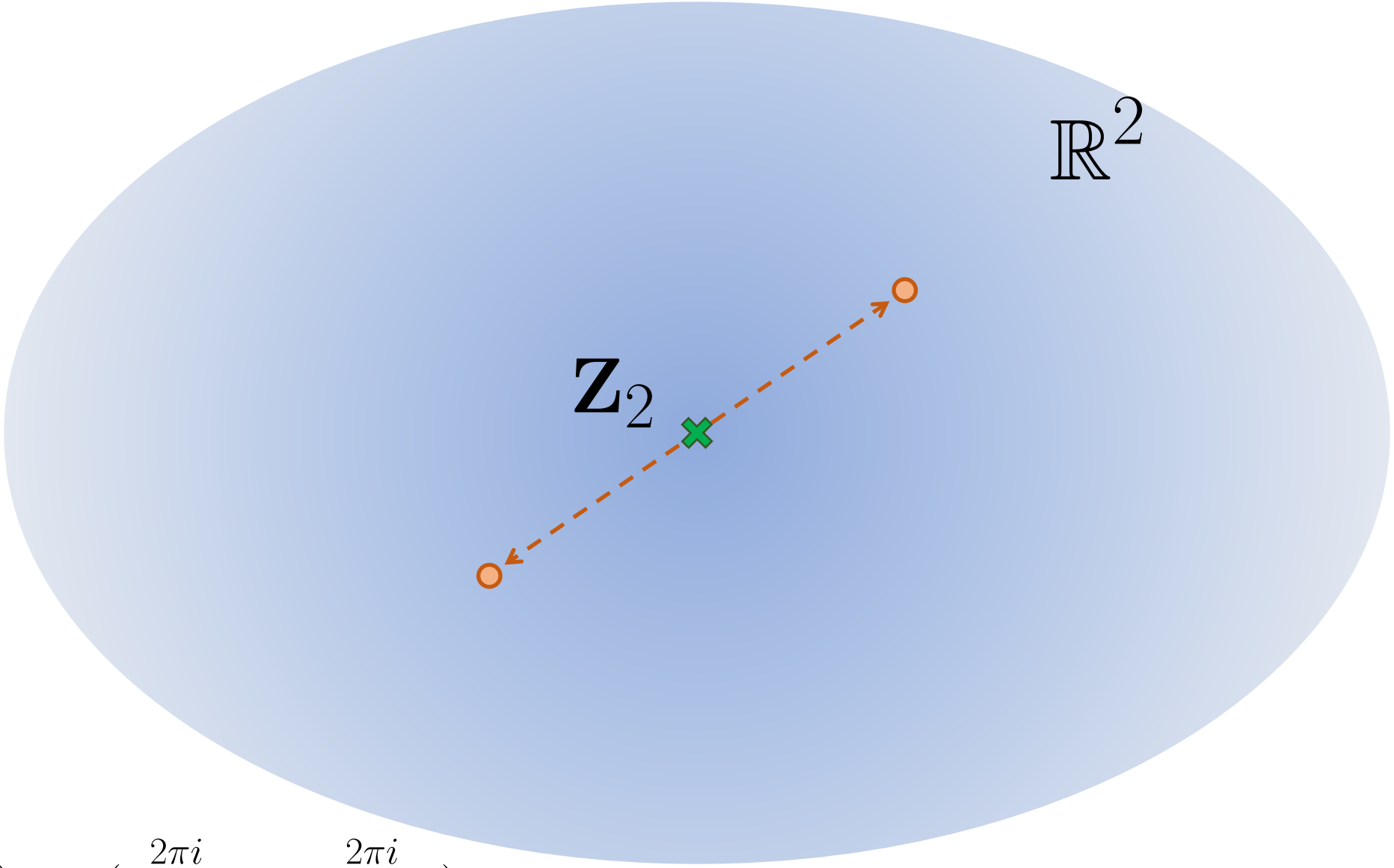


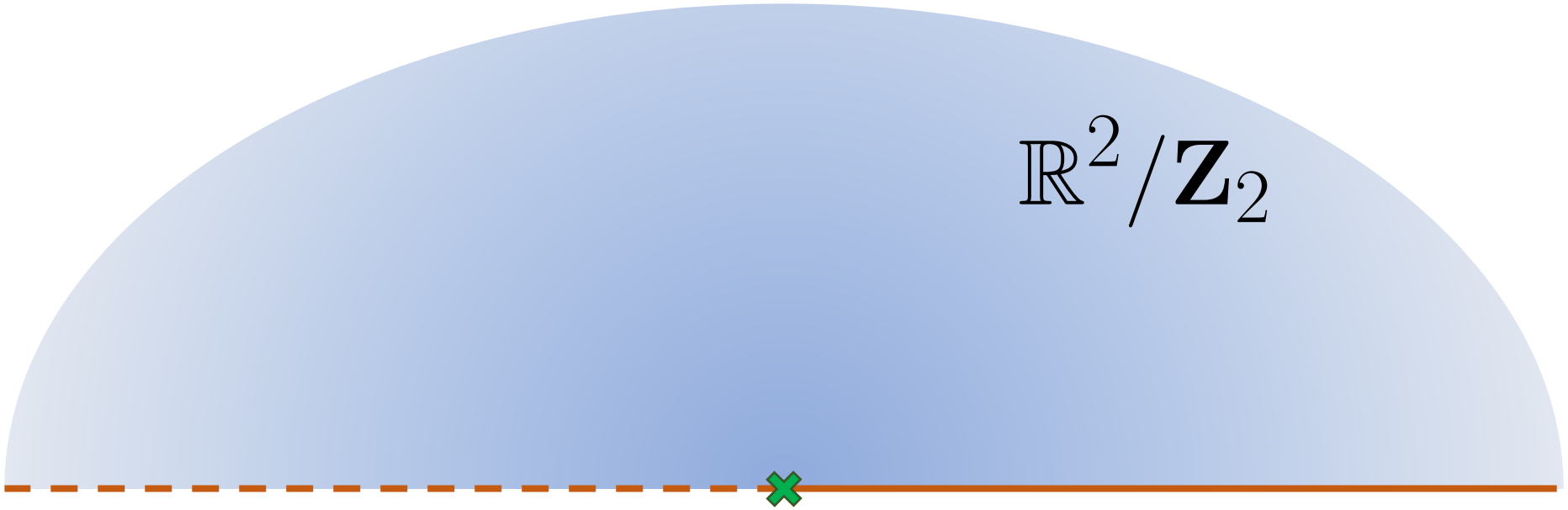
Smooth ending of spacetime!

$$ds^2 = f_4^2 ds^2_{AdS_4} + f_1^2 ds^2_{\mathbf{S}_1^2} + f_2^2 ds^2_{\mathbf{S}_2^2} + 4\rho^2(dr^2 + r^2 d\varphi^2)$$

WHAT ORBIFOLDS ARE AND HOW THEY BREAK SUSY



$$\Theta : \ (x, y) \to (e^{\frac{2\pi i}{k}} \, x, \, e^{-\frac{2\pi i}{k}} \, y) \qquad k = 2$$


$\mathbb{R}^2/\mathbf{Z}_2$

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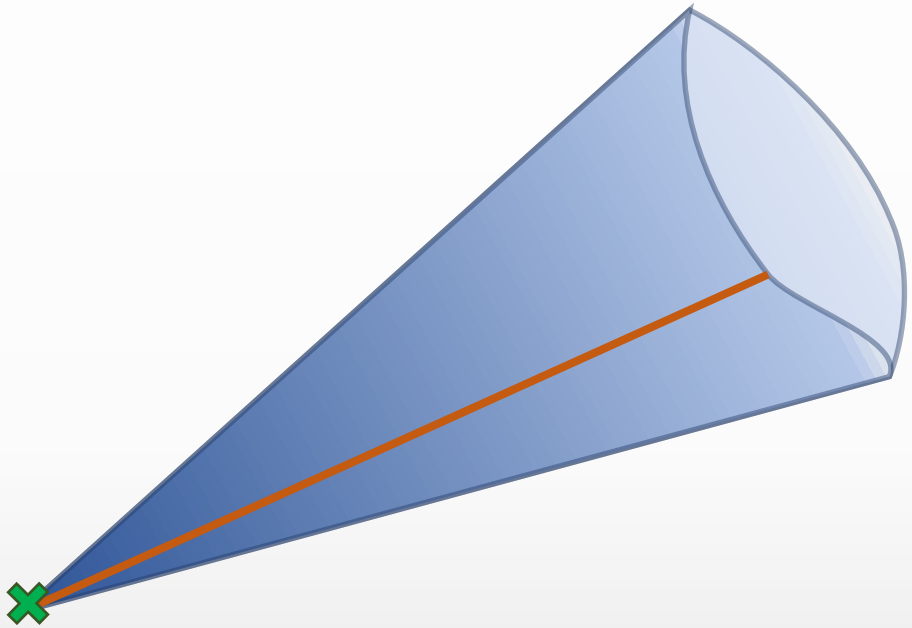

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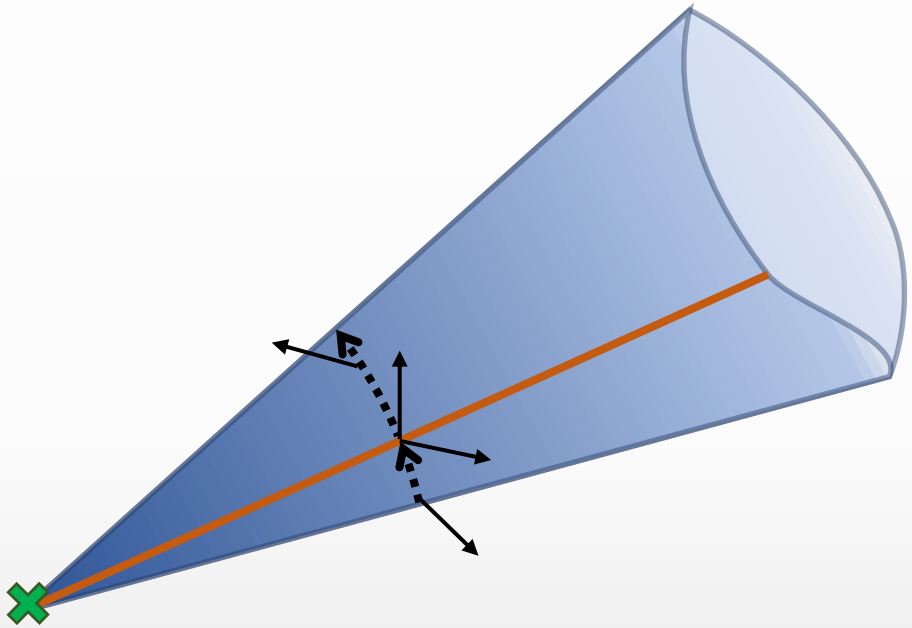

4D N=4

D3-branes in flat space

The gravity dual is type IIB in $\mathrm{AdS}_5 \times \mathbf{S}^5$

4D N=2 ORBIFOLDS

D3-branes in a $\mathbf{C}^2/\mathbf{Z}_k$ singularity.

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$$\Theta : (z_1, z_2) \rightarrow (e^{\frac{2\pi i}{k}} z_1, e^{-\frac{2\pi i}{k}} z_2)$$

$$z_1 = x^4 + ix^5$$
$$z_2 = x^7 + ix^8$$

$D3$	0	1	2	3	$\times$	$\times$	$\times$	$\times$	$\times$	$\times$

THE GRAVITY DUAL OF 4D N=2 ORBIFOLDS

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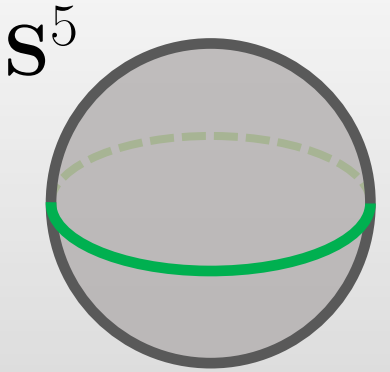

$\mathbf{S}^1$ fixed points

ORBIFOLDS IN END OF THE WORLD BRANES

ETW-BRANES FOR 4D N=2 ORBIFOLDS (Z_K ORBIFOLD)

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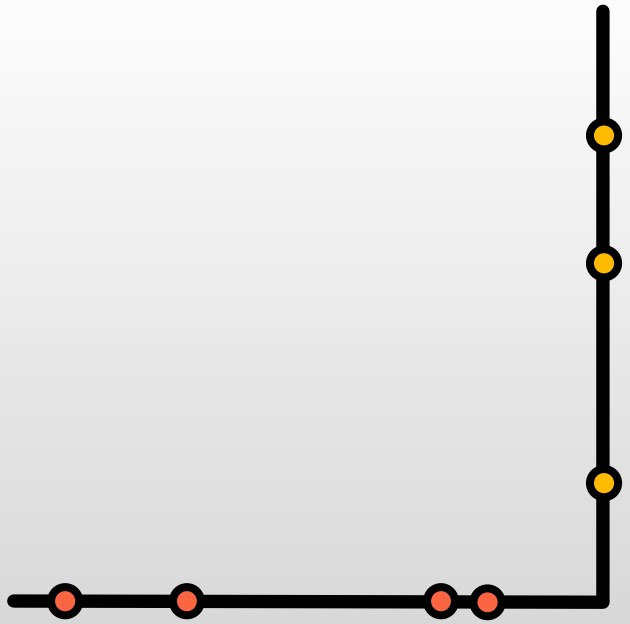

$D3$	0	1	2	3	×	×	×	×	×	×
$D5$	0	1	2	×	4	5	6	×	×	×
$NS5$	0	1	2	×	×	×	×	7	8	9

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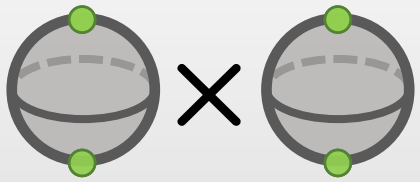

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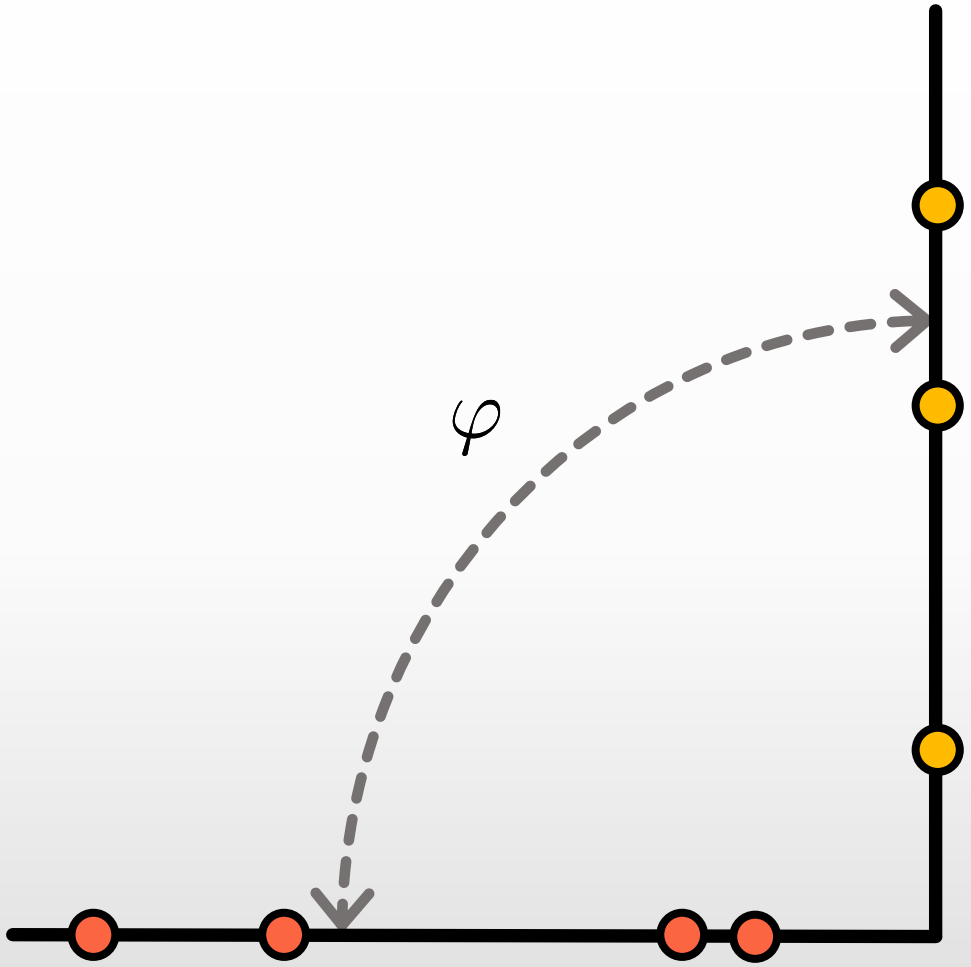
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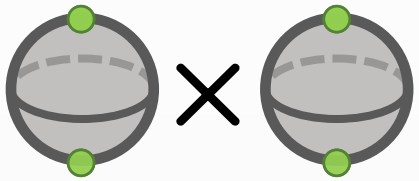

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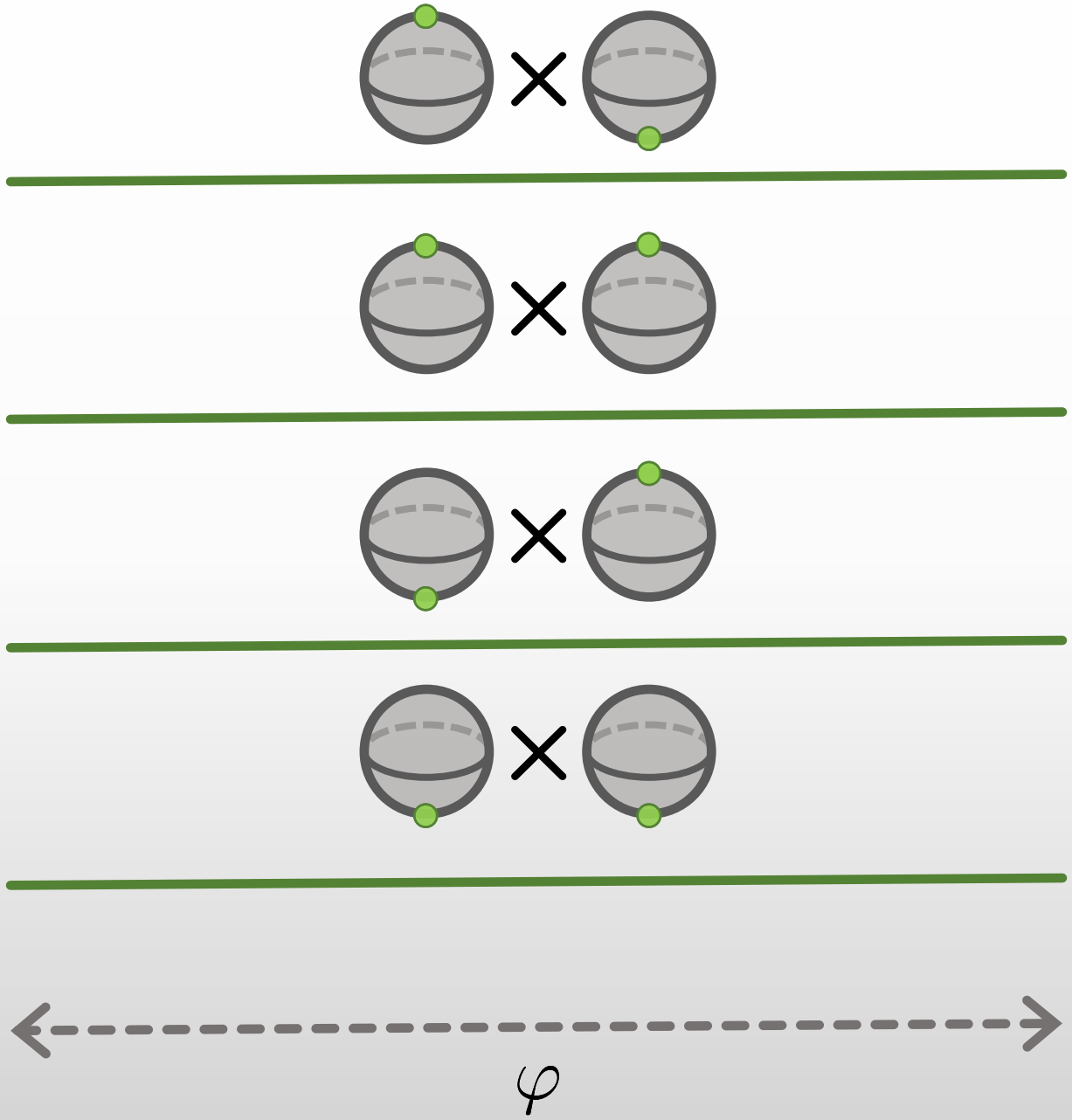
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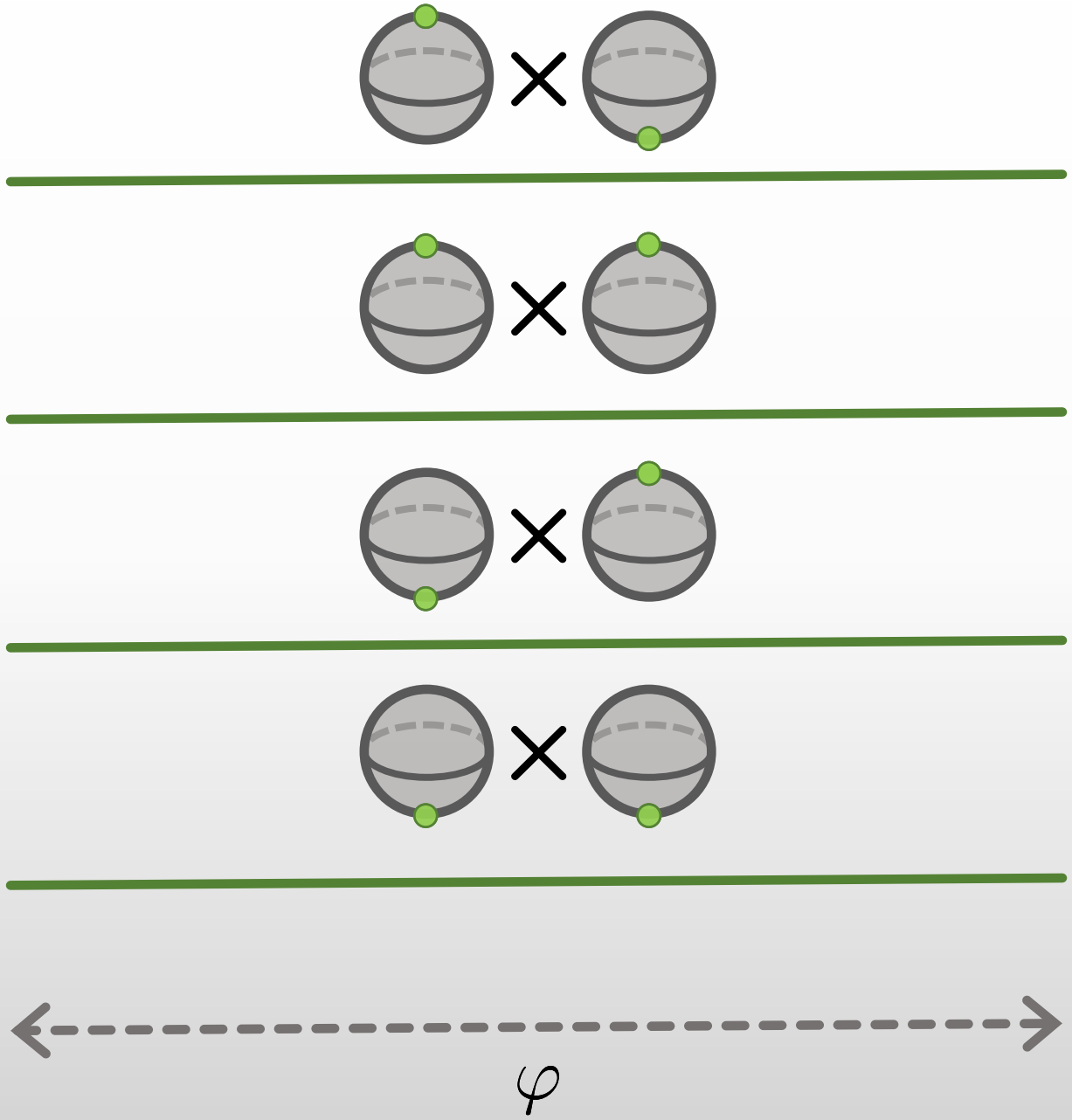
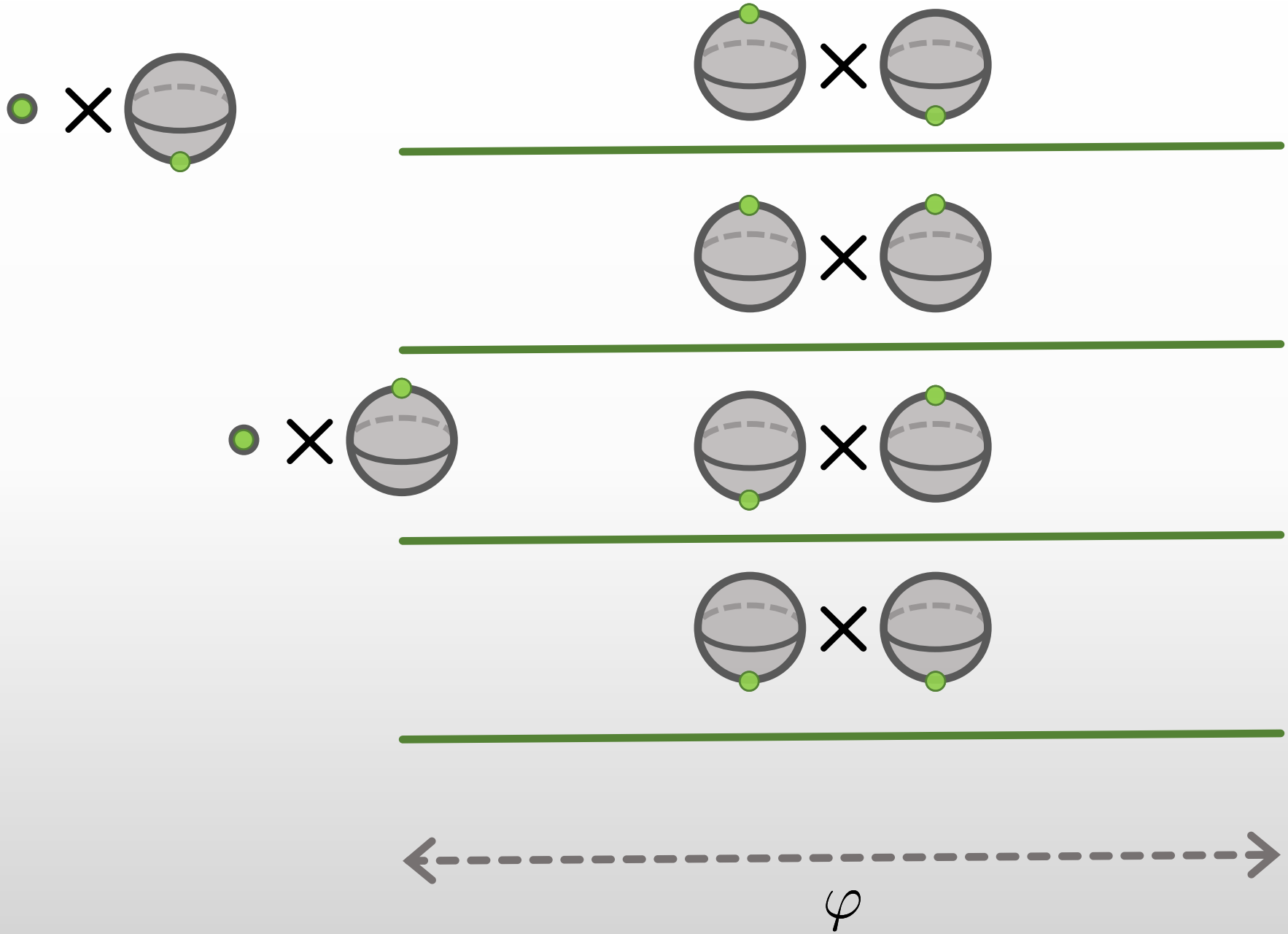


4 copies of
twisted fields?!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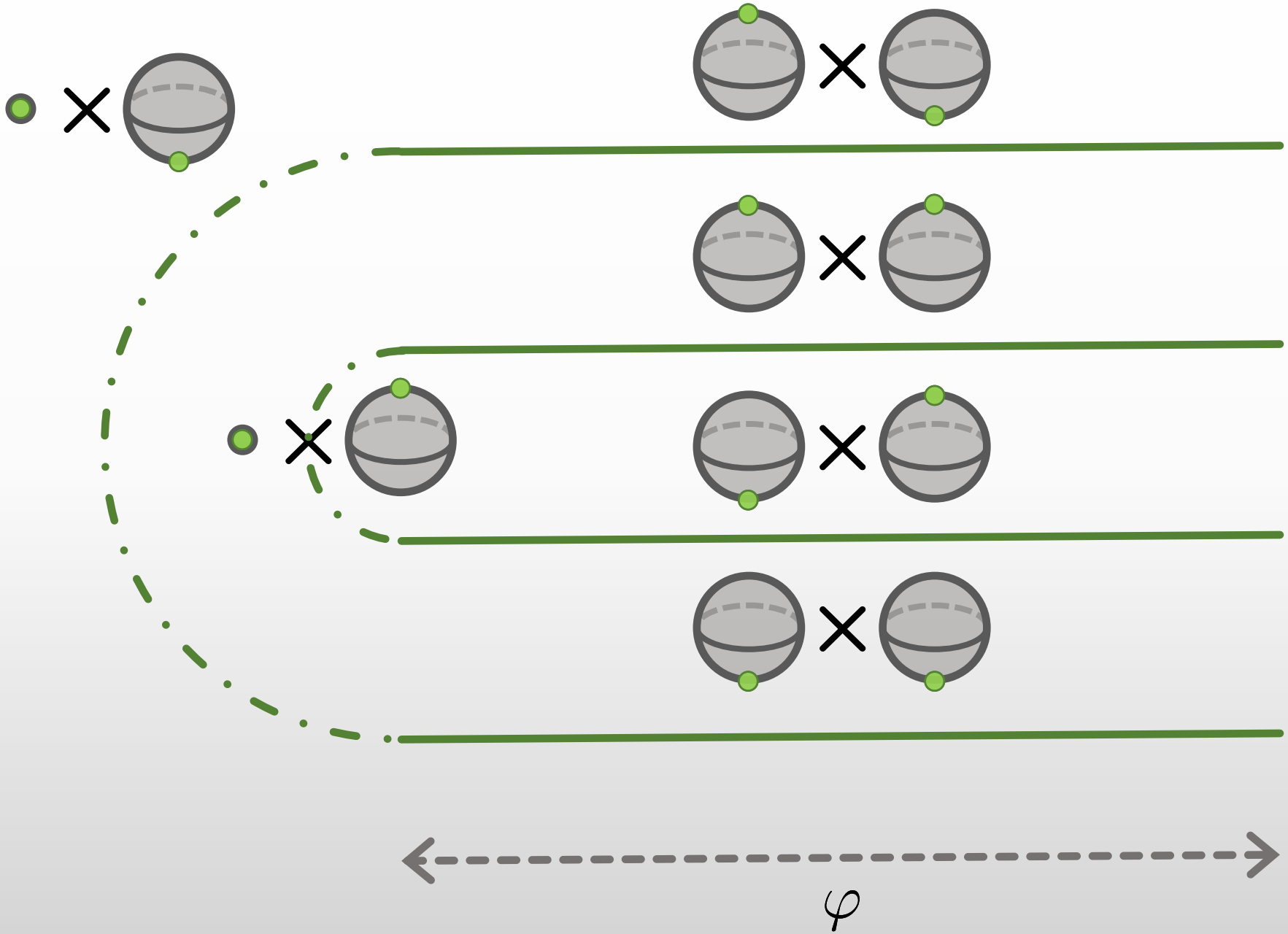
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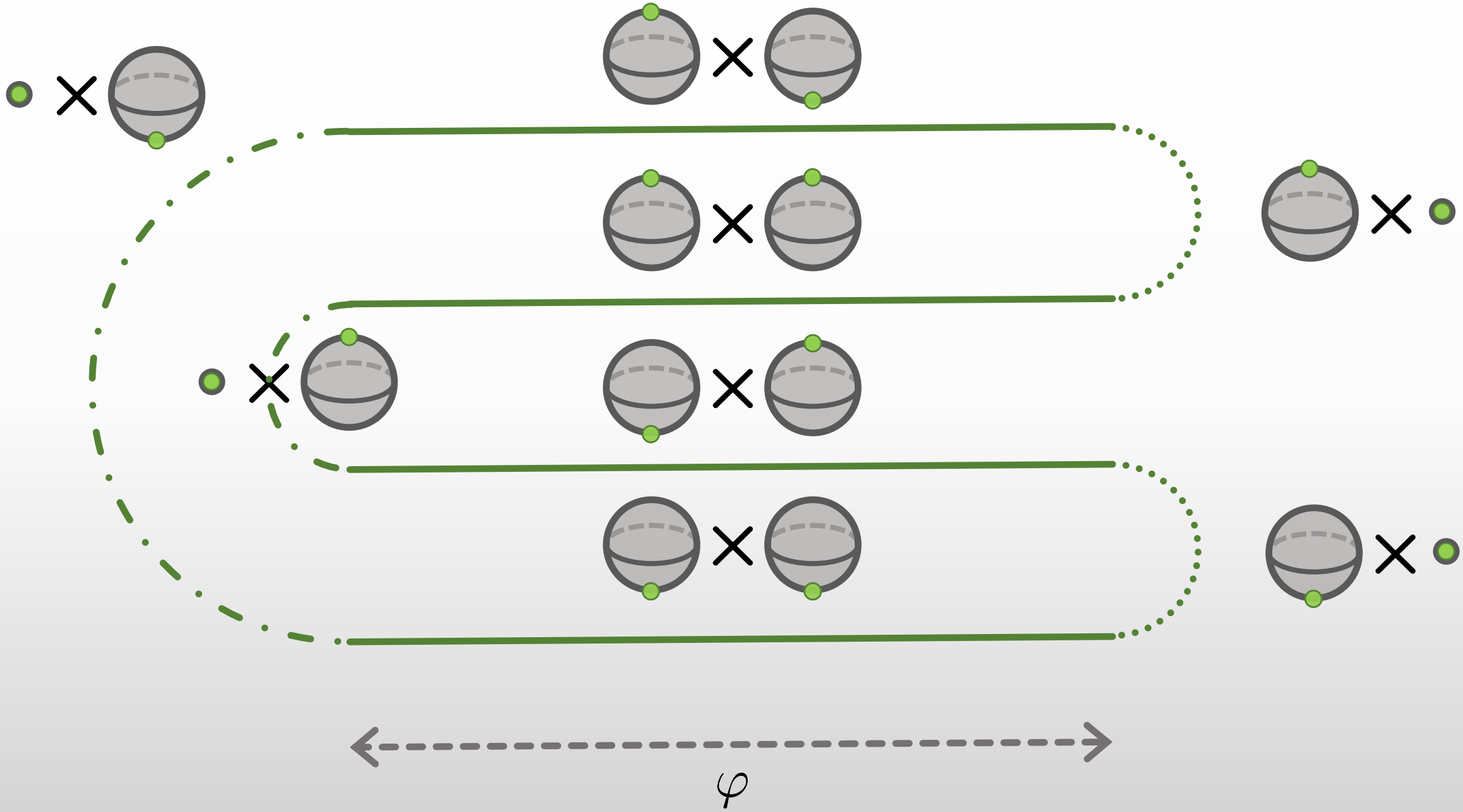
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4D N=3 S-FOLD

D3-branes on a $\mathbf{C}^4/\mathbf{Z}_4$ singularity

The gravity dual is a F-theory fibration over $\mathrm{AdS}_5 \times \mathbf{S}^5/\mathbf{Z}_4$

$$\begin{aligned} \Theta: (x_4, x_5, x_6) &\to (x_7, x_8, x_9) \\ (x_7, x_8, x_9) &\to (-x_4, -x_5, -x_6) \\ \tau &\to -1/\tau \end{aligned}$$

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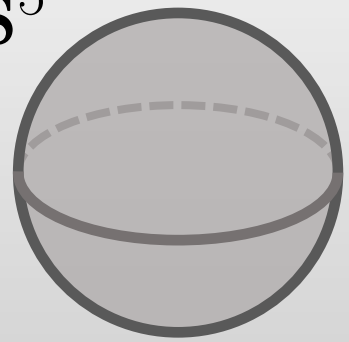
$\mathbf{S}^5$



Acts freely!

ETW BRANES FOR 4D N=3 S-FOLD

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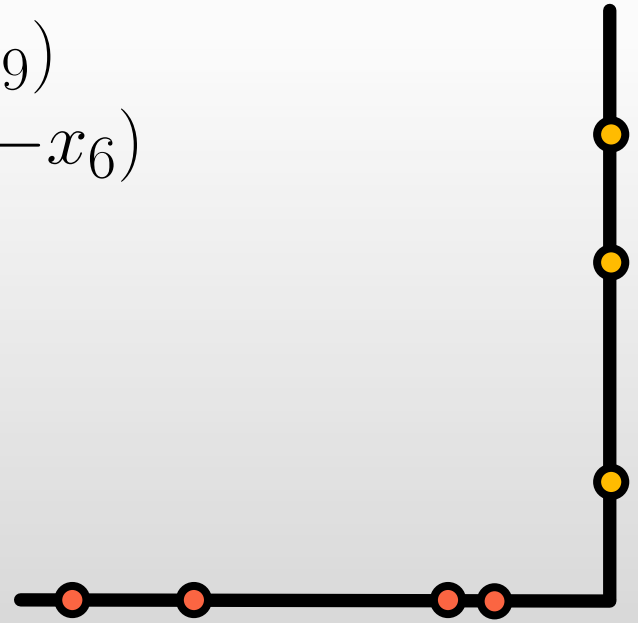

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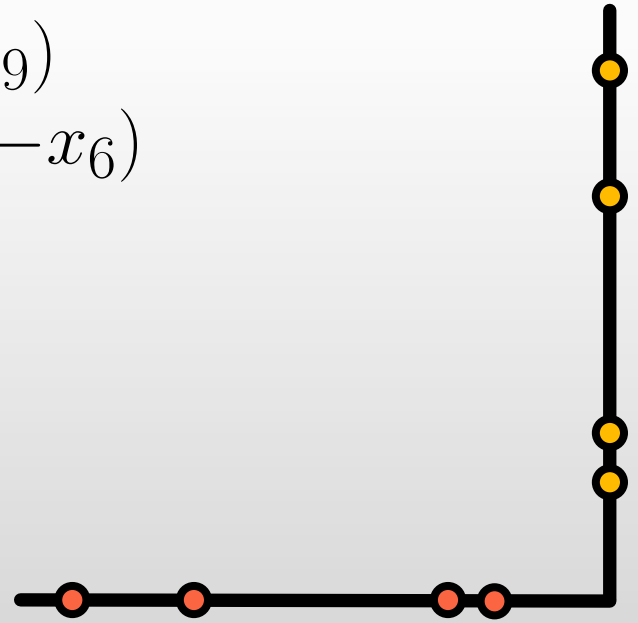

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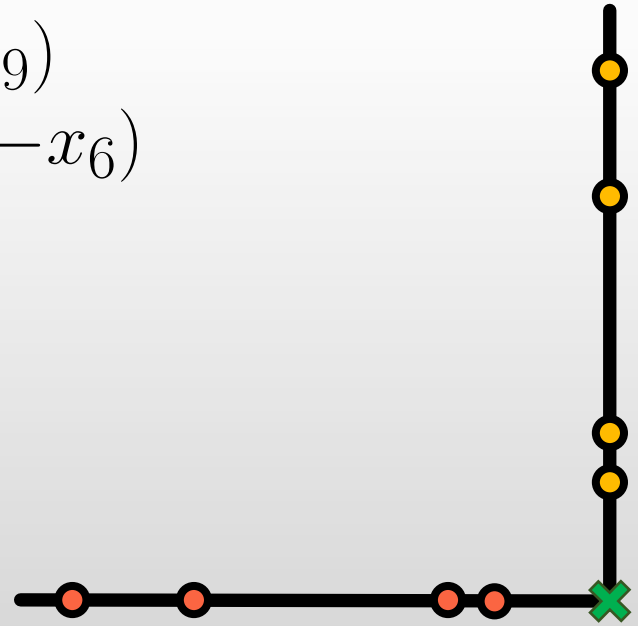

Fixed point!!

CONCLUSIONS

SUMMARY

- Cobordism defect of $AdS_5 \times S^5$!!
- 4d N=2 for ETW configurations
- 4d N=3 S-folds for ETW configuration with the discover of a novel fixed point

THANK YOU!