

# Brane models of 2+1 dimensional fermions

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# The $Dp$ - $Dq$ program

The problem:

Strongly-coupled fermions in 2+1 dim (e.g. FQHE)

The idea:

$Dp$ - $Dq$  with  $\#ND = 6$

- fundamental fermions at intersection
- $Dq$  probe in  $Dp$  background
- ~~SUSY~~  stability?
- $T, D, B > 0$

3+1 dim cousins: Sakai-Sugimoto & D3-D7

Examples

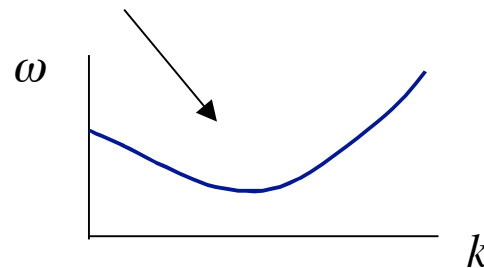
- D3-D7'
- D2-D8'
- 2+1 dim modified Sakai-Sugimoto

Top-down fishing expedition

# The Results

## Minkowski embeddings - Quantum Hall states

gapped, stable  
filling fraction  $\nu =$   $\begin{cases} \text{irrational} & \text{D3-D7'} \\ 1 & \text{D2-D8'} \\ n/2 & \text{2+1 SS} \end{cases}$   
magneto-rotons



## Black Hole embeddings - Metallic states

Non-Fermi Liquids

Ferromagnetism and anomalous Hall effect

Resistivity saturation

Zero Sound Mode

NOP Instability:

Gauge + Axion,  $E$ -field  $\Rightarrow$  instability at  $k > 0$