The Conifold's Competing Condensates[1]

Diederik Roest

University of Groningen

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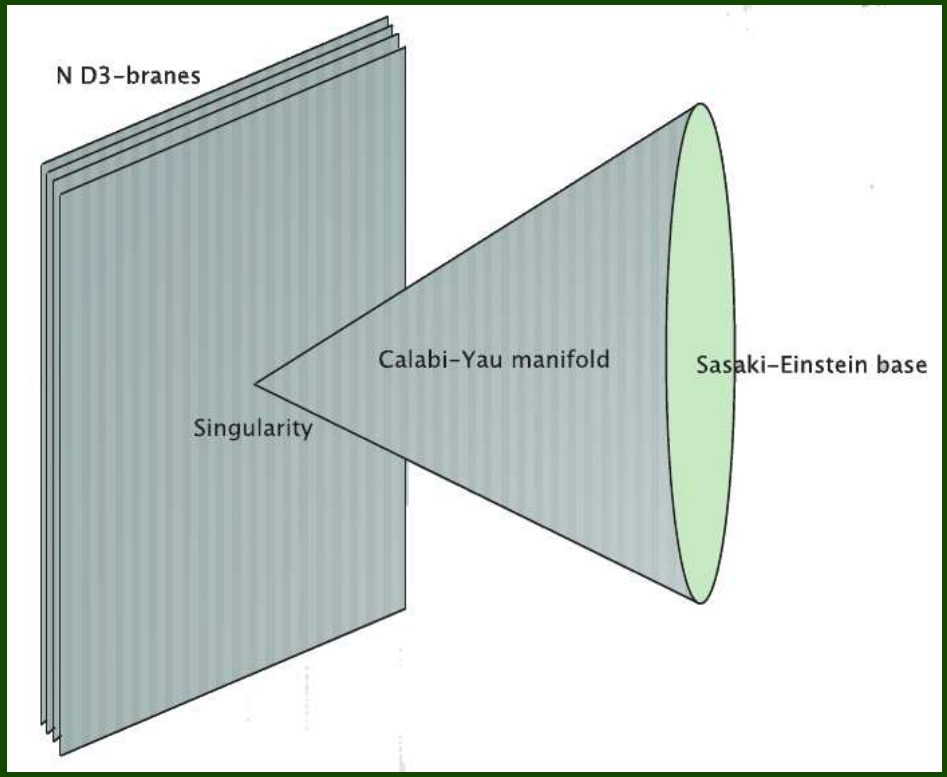
[1] ArXiv:1205.2087 with F. Aprile, A. Borghese, A. Dector and J. Russo

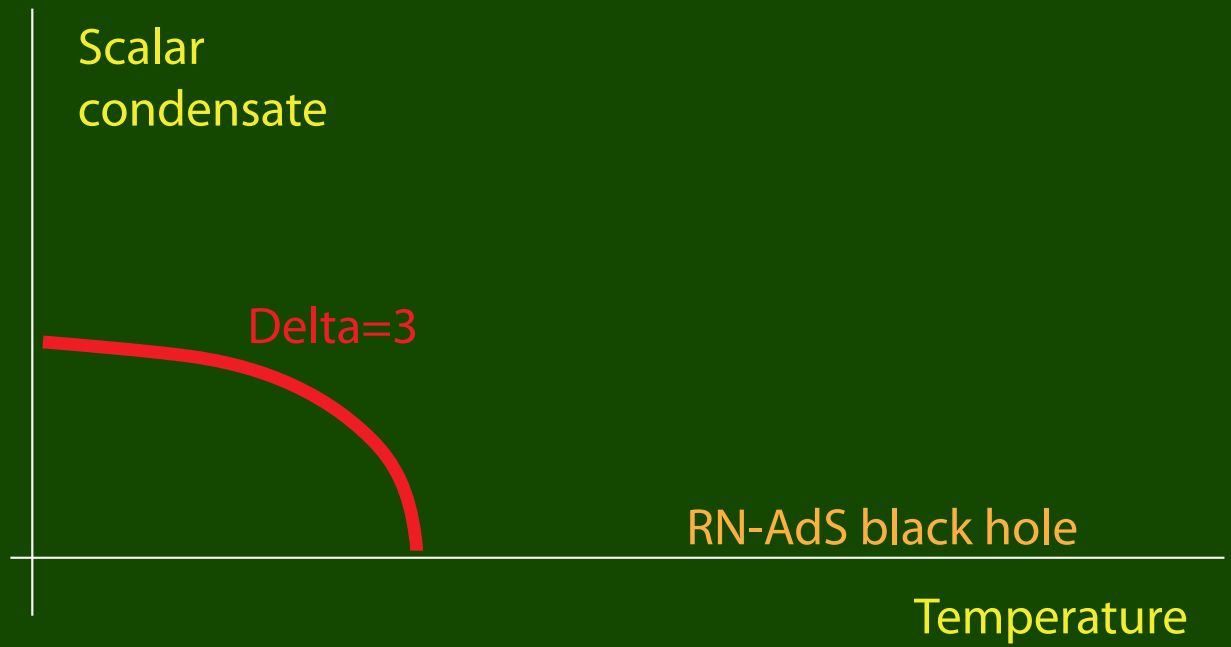
Holographic duality



$\mathcal{N} = 1$ SYM $\quad \Leftrightarrow \quad$ IIB on $\mathbf{AdS}_5 \times \mathbf{X}^5 = \begin{cases} \mathbf{S}^5 = SO(6)/SO(5) \\ \mathbf{T}^{1,1} = SU(2) \times SU(2)/U(1) \end{cases}$

Holographic superconductivity

Corresponds on the gravity side to a black hole that grows hair:



Universal mode with $\Delta = 3$ for all SE[1] with mass and charge

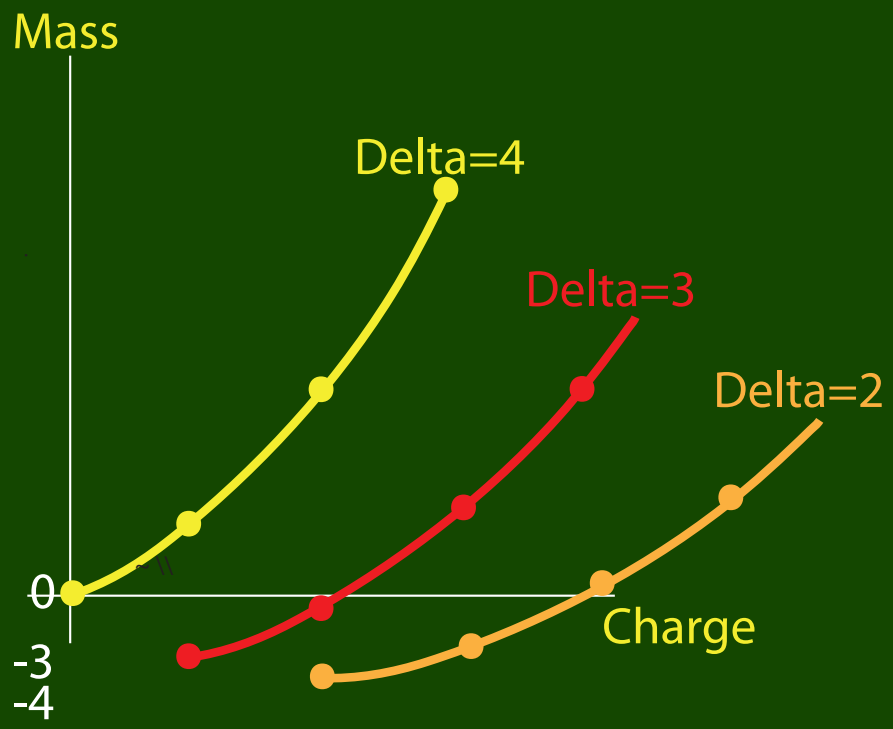
$$M^2 = \Delta(\Delta - 4)\,, \qquad Q = {}^2\!/_3\Delta\,.$$

Higher T_c for lower Δ. What about examples of S^5 and $\mathrm{T}^{1,1}$?

[1] (Gubser, Herzog, Pufu, Tesileanu '09)

Competing condensates in flat space

Spectrum of IIB on S^5 includes a number of modes[1] with $\Delta = 2$, leading to higher T_c. Contained in truncation to maximal supergravity, capturing higher-order terms.



Is this mode going to dominate the thermodynamics[2]?

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[1] (Kim, Romans, Van Nieuwenhuizen "85)

[2] (Aprile, DR, Russo '11)

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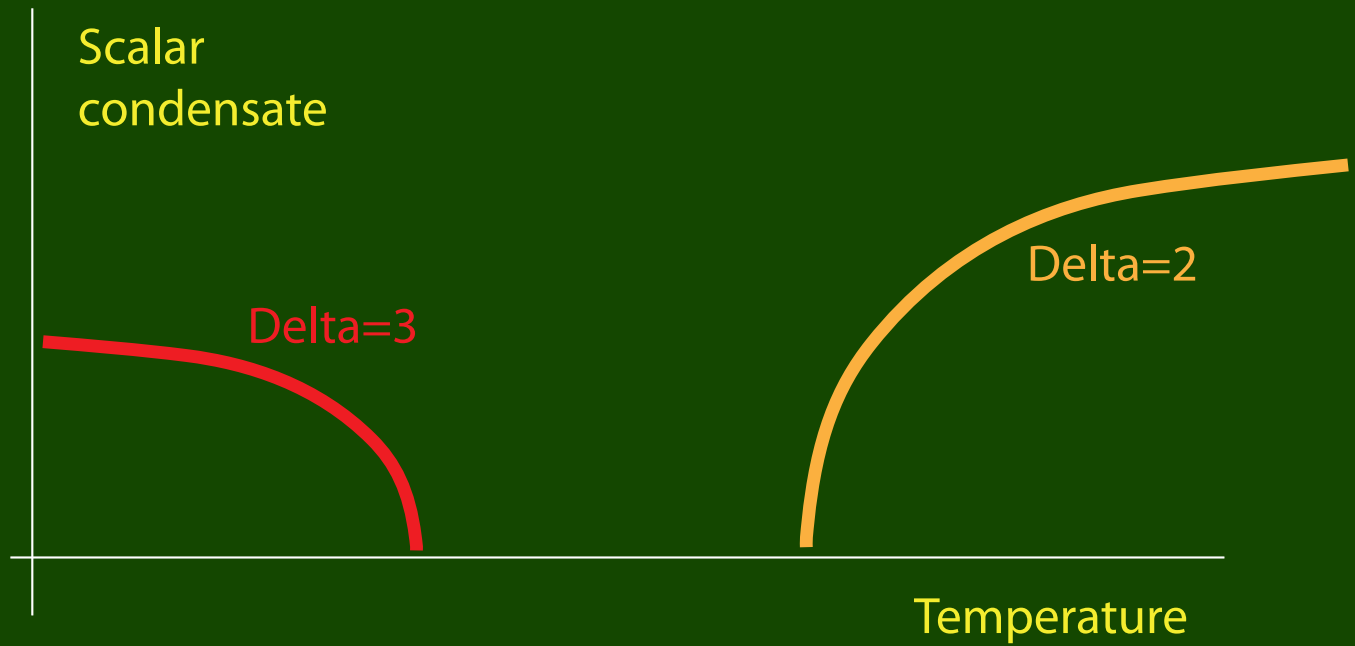


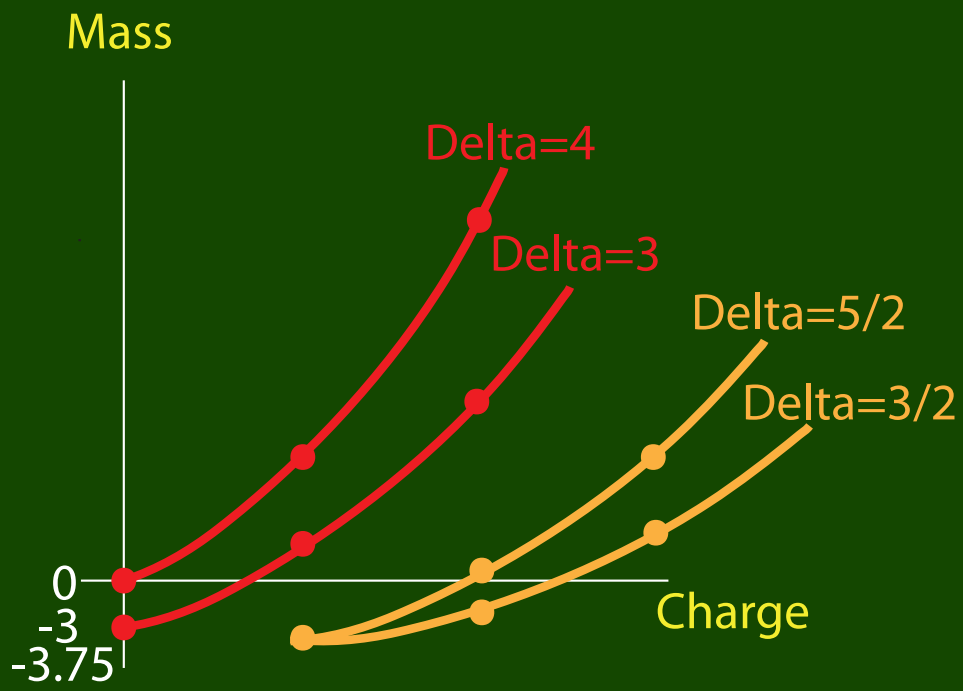
Retrograde condensation[2]: subdom. condensate *above* T_c.

[1] (Kim, Romans, Van Nieuwenhuizen "85)

[2] (Aprile, DR, Russo '11)

Competing condensates on the conifold

Spectrum of IIB on $T^{1,1}$ includes a number of modes[1] with $\Delta = 3/2$, leading to even higher T_c:



But what about the higher-order terms? Not included in any truncation so far! Explicit proposal if this truncation is consistent[2].

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[1] (Ceresole, Dall'Agata, D'Auria, Ferrara '99)

[2] (Aprile, Borghese, Dector, DR, Russo '12)

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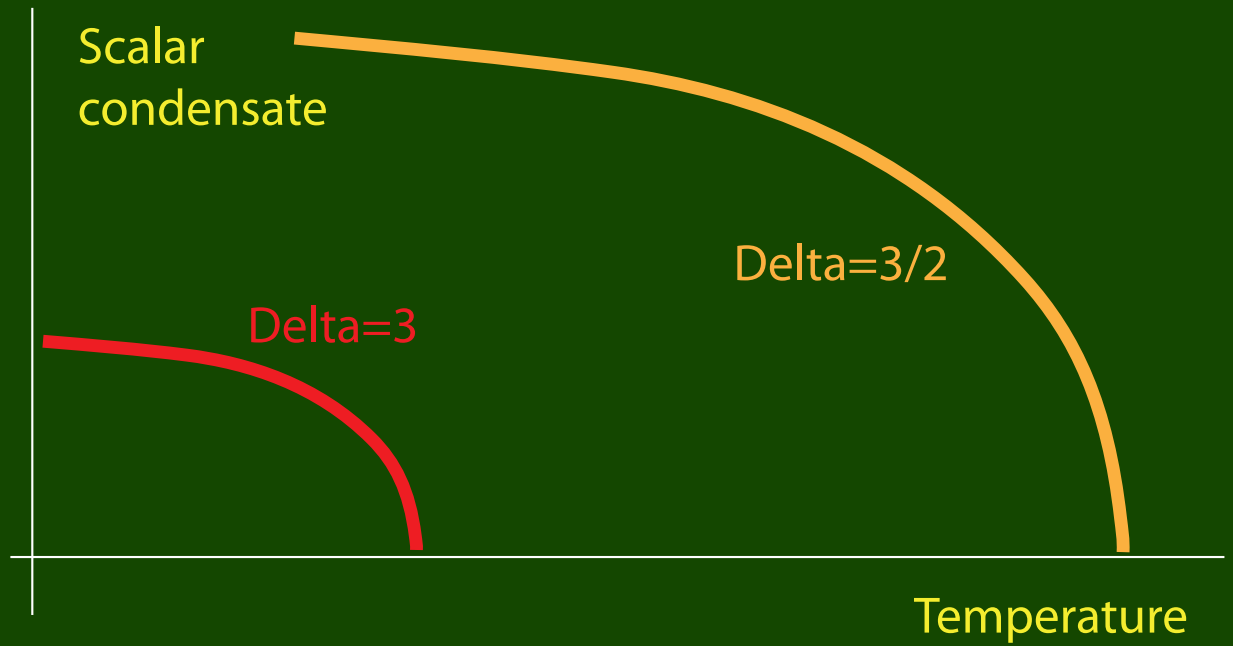

IF the truncation to the $\Delta = 3/2$ mode at the bottom of the other KK tower is consistent, then indeed it dominates[2].

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[1] (Ceresole, Dall'Agata, D'Auria, Ferrara '99)

[2] (Aprile, Borghese, Dector, DR, Russo '12)

Conclusions

Fate of holographic superconductivity determined by competion of different condensates. Generic Sasaki-Einstein mode with $\Delta = 3$. Special cases:

- S^5: $\Delta = 2$ mode has higher T_c but higher-order terms in maximal supergravity prevent it from condensing...
- $T^{1,1}$: $\Delta = 3/2$ mode has higher T_c and condensation depends on higher-order terms.

Explicit proposal for consistent truncation to second KK hypermultiplet. Shown that this indeed condenses first!

Open questions: novel mechanism for consistent truncations / different dynamics describing this mode?

THANKS!