2d $\mathcal{N} = (2, 2)$ SYM on computer

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- I. Kanamori, H.S., arXiv:0809.2856, Nucl. Phys. B in press
- I. Kanamori, H.S., arXiv:0811.2851

Personal Motivation

- Nonperturbative dynamics of SUSY gauge theories
  - Seiberg-Witten $\Leftrightarrow$ IIA NS5 wrapping Σ in CY_3 $\Leftrightarrow$ Nekrasov formula
  - ISS $\Leftrightarrow$ NS5-D6-D4 $\Leftrightarrow$ Seiberg duality

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- Gauge/gravity correspondence

SUSY vs Lattice?

- Manifest SUSY would be *impossible*, because

$$\{Q^A_\alpha, (Q^B_\beta)^\dagger\} = 2\delta^{AB}\sigma^m_{\alpha\dot{\beta}}P_m$$

- However, at least a linear combination Q of Q^A_α and $(Q^B_\beta)^\dagger$ such that

$$\{Q, Q\} = 2Q^2 = 0$$

  could be realized even on the lattice
- Moreover, *if* the continuum action S can be written as

$$S = QX$$

  Q-invariance of S could be promoted to lattice symmetry!

Restoration of Full SUSY?

- The above lattice formulation possesses a manifest lattice symmetry Q
  - Cohen, Kaplan, Katz, Ünsal, Endres
  - Sugino
  - Catterall
  - D'Adda, Kanamori, Kawamoto, Nagata
  - Damgaard, Matsuura
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- But how about other SUSY generators?
- The best thing we may hope is that these are restored in the continuum limit $a \to 0$
- It can be argued, owing to Q, this really occurs for lower dimensional SUSY gauge theories...

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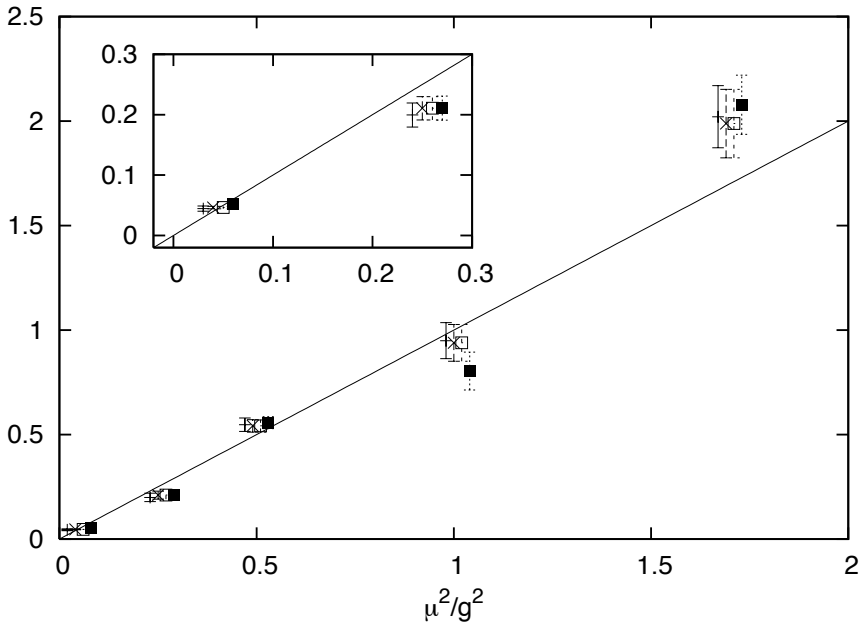
- Numerically studied some physical questions
  - Gapless mass spectrum
  - Static potential between charges in the fundamental reps.

PCSC!

- The continuum limit of the ratio

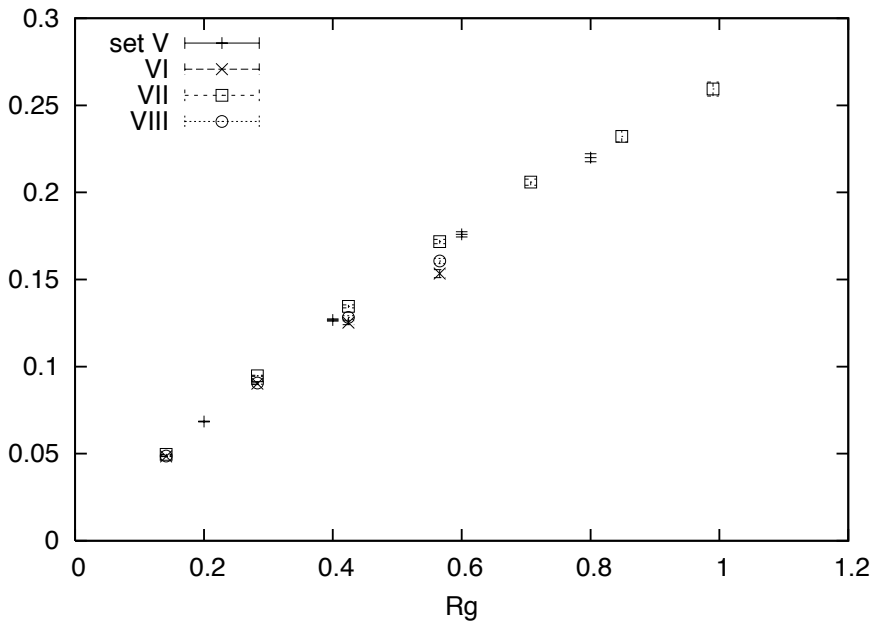
$$\frac{\partial_\mu \langle (s_\mu)_i(x)(f_0)_i(0)\rangle}{\langle (f)_i(x)(f_0)_i(0)\rangle} \left(\Rightarrow \frac{\mu^2}{g^2}\right)$$



Static Potential between Charges in Fund. Reps.

- Static potential between charges in the fundamental representation $V(R)/g$

$$-\ln\{W(T,R)\} = V(R)T + c(R)$$



- This confining behavior appears distinct with a conjecture in the '90s by Armoni, Frishman and Sonnenschein