Composite superconformal string model as a new class of hadron string models.

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Classical string models

- Original purpose
  - to describe hadron interaction

- Unsolved problems
  - requirement of interception of leading meson trajectory equal to 1
  - description of deep inelastic scattering
  - degeneration in parity of fermions
New hadron string model

- It is able to solve problems of classical strings
- It has a set advantages for description of hadrons:
  - Approximately linear Regge trajectories
  - Possibility of hadron description at low energies. Hadron scale $\alpha'$ is of order $1\,\text{GeV}^{-2}$
  - Possibility to calculate interaction amplitudes
Description of hadrons

- There is a set of two-dimensional fields and their two-dimensional superpartners.
- Conditions of supersymmetry are satisfied only on two-dimensional world sheet.
- There are a special type of fields propagating only between neighboring vertices.
- Additional sheets carry quark quantum numbers.
Meson description

- There are two types of vertices:
  \[ V \sim [G, e^{ikX}] \]
  \[ V \sim \{G, F : e^{ikX}\} \]

- The following amplitudes computed

  \[
  A_{\pi\pi} = -g^2 Tr(\Gamma_{12} \Gamma_{23} \Gamma_{34} \Gamma_{41}) \frac{\Gamma(1 - \alpha_t^\rho) \Gamma(1 - \alpha_s^\rho)}{\Gamma(1 - \alpha_t^\rho - \alpha_s^\rho)}
  \]

  \[
  A_{\pi K} = -g^2 \lambda_K^2 (\Gamma_{12} \Gamma_{23} \Gamma_{34} \Gamma_{41}) |F_K|^2 \frac{\Gamma(1 - \alpha_t^{K\star}) \Gamma(1 - \alpha_s^\rho)}{\Gamma(1 - \alpha_t^{K\star} - \alpha_s^\rho)}
  \]

  \[
  A_{K K} = g^2 \lambda_K^4 (\Gamma_{12} \Gamma_{23} \Gamma_{34} \Gamma_{41}) |F_K|^4 \left( \frac{\Gamma(-\alpha_t^\phi) \Gamma(1 - \alpha_s^\rho)}{\Gamma(1 - \alpha_t^\phi - \alpha_s^\rho)} - \frac{\Gamma(1 - \alpha_t^\phi) \Gamma(1 - \alpha_s^\rho)}{\Gamma(1 - \alpha_t^\phi - \alpha_s^\rho)} \right)
  \]

- Where
  \[
  \alpha_t^\rho = \frac{1}{2} + \frac{t}{2} \quad \alpha_s^\rho = \frac{1}{2} + \frac{s}{2} \quad \alpha_t^{K\star} = -\frac{m_K^2}{2} + \frac{1}{2} + \frac{t}{2} \quad \alpha_t^\phi = \frac{t}{2} - m_k^2 + \xi_s^2
  \]

are Regge trajectories
Baryon description

- For baryons we need three additional sheets.
- Baryons are described by the same fields as mesons.
- The model gives a way of eliminating degeneracy in parity of fermions.
Conclusions

- It is a new type of hadron string model.
- The leading meson trajectory has the intercept $\frac{1}{2}$.
- Supersymmetry conditions are satisfied on the two-dimensional sheet only.
- Physical spectrum of states are free from ghosts.
- The model have an opportunity to eliminate degeneracy in parity of fermions.
Thank you!