

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

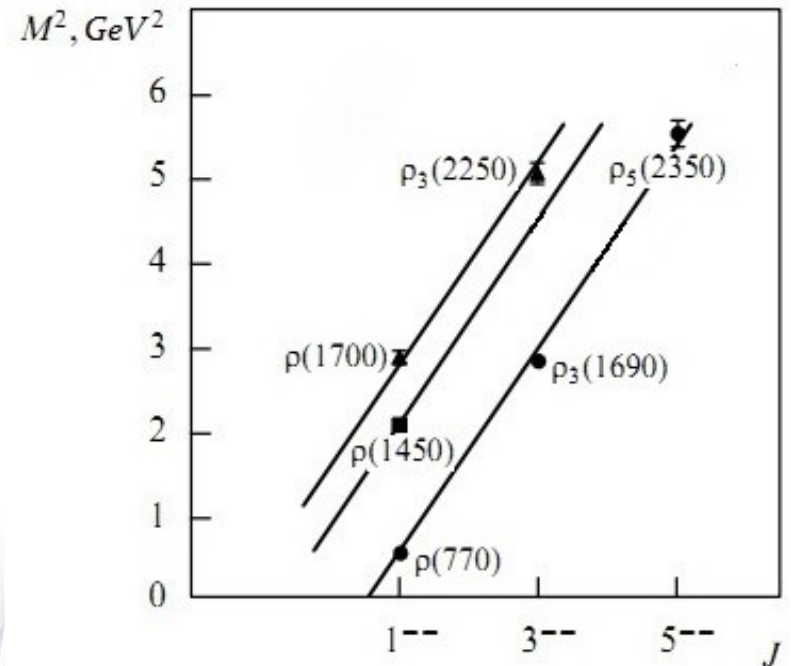
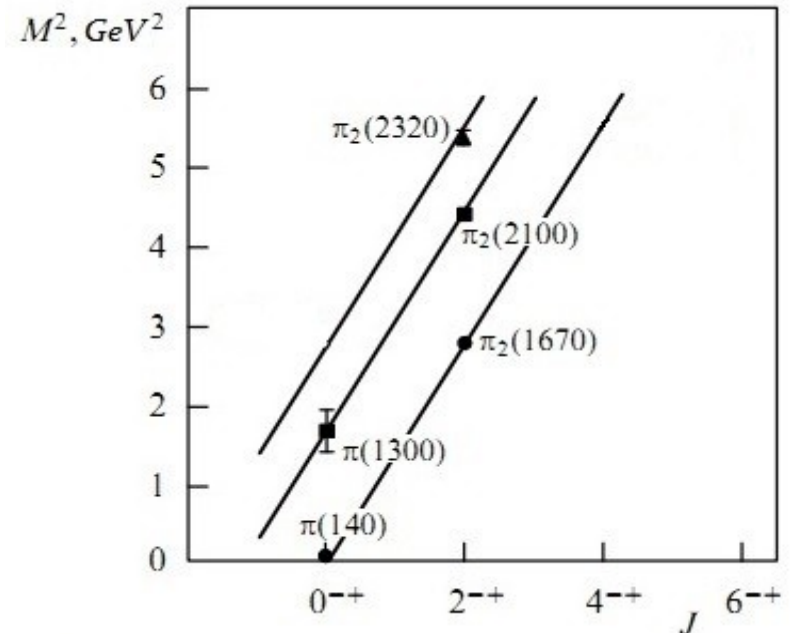
A.Semenova
Petersburg Nuclear Physics Institute

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

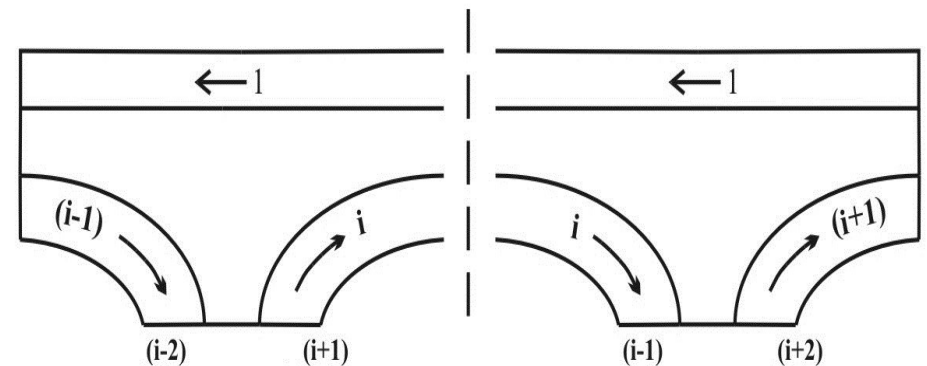
New hadron string model

- 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 α' is of order 1GeV^{-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 type of vertices:

$$V \sim [G, :e^{ikX} :]$$

$$V \sim \{G, F :e^{ikX} :\}$$



- The following amplitudes computed

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

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

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

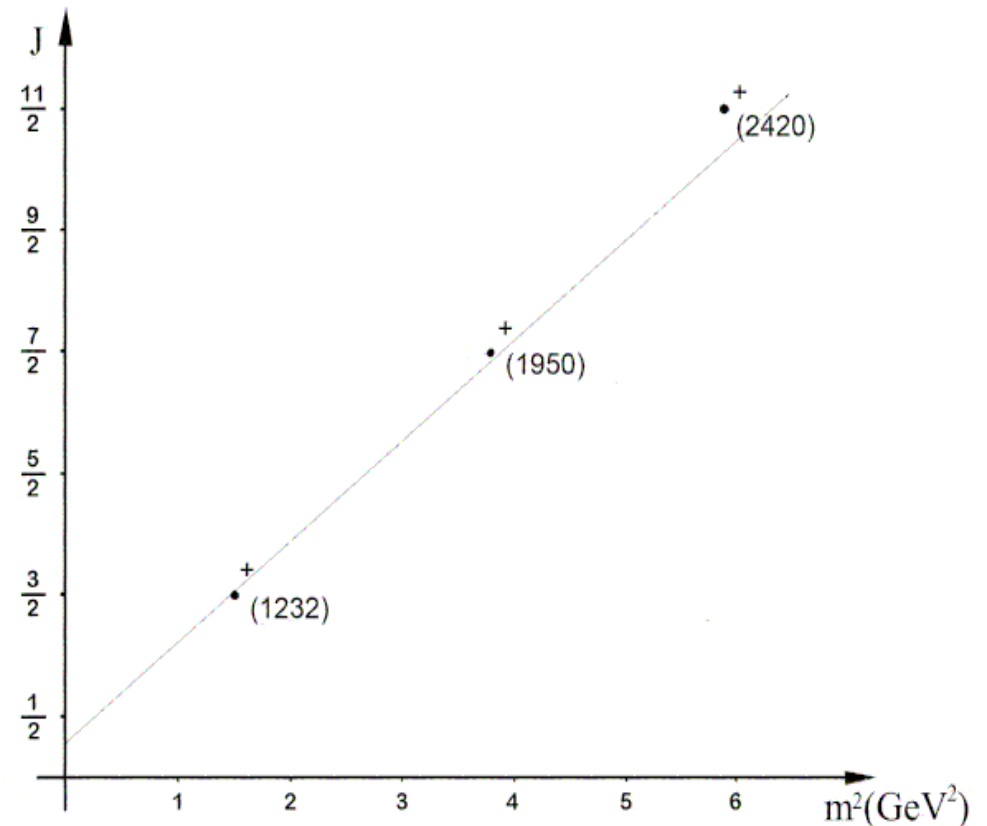
- Where $\alpha_t^\rho = \frac{1}{2} + \frac{t}{2}$ $\alpha_s^\rho = \frac{1}{2} + \frac{s}{2}$ $\alpha_t^{K^*} = \frac{-m_K^2}{2} + \frac{1}{2} + \frac{t}{2}$ $\alpha_t^\phi = \frac{t}{2} - m_k^2 + \xi_s^2$

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.

The background features a complex, abstract pattern of thin, overlapping lines in red and blue. These lines form a series of interconnected, slightly offset rectangular and square shapes, creating a 3D wireframe effect. The lines are most dense and visible at the corners and edges, fading towards the center. The overall color palette is a mix of vibrant red and a muted, dusty blue, set against a plain white background.

Thank you!