The Λ(1405) in lattice QCD

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Abstract: We present ongoing work on the study of the two pole structure of the Λ (1405) baryon at the SU(3) point. We construct the interpolation operators from the direct product of the pseudo-scalar meson and baryon octets. In the future we will implement a distillation procedure, extract the discrete energy spectrum and use it to extract the scattering amplitudes and obtain the location of the poles in the complex energy plane.

Introduction

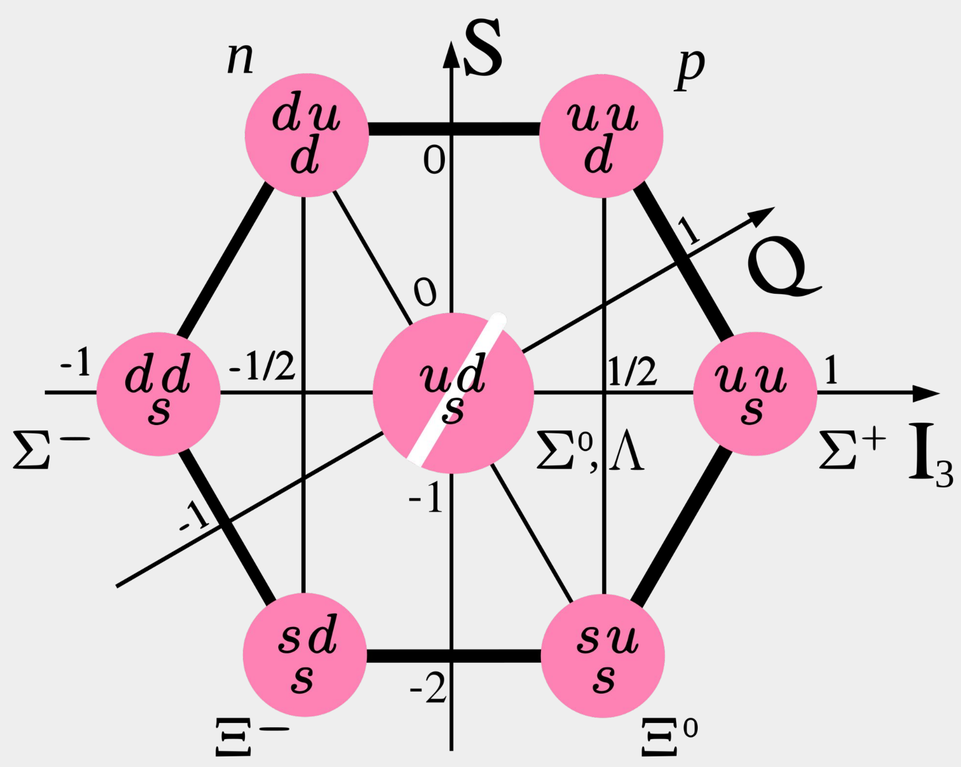
- Λ(1405) is a 4 star resonance
- I (J^P) = 0($1/2^-$) M_Λ=1405 MeV Γ_Λ=50.5 MeV
- ***uds*** Quark content S=-1
- Quark Model cannot accommodate its structure

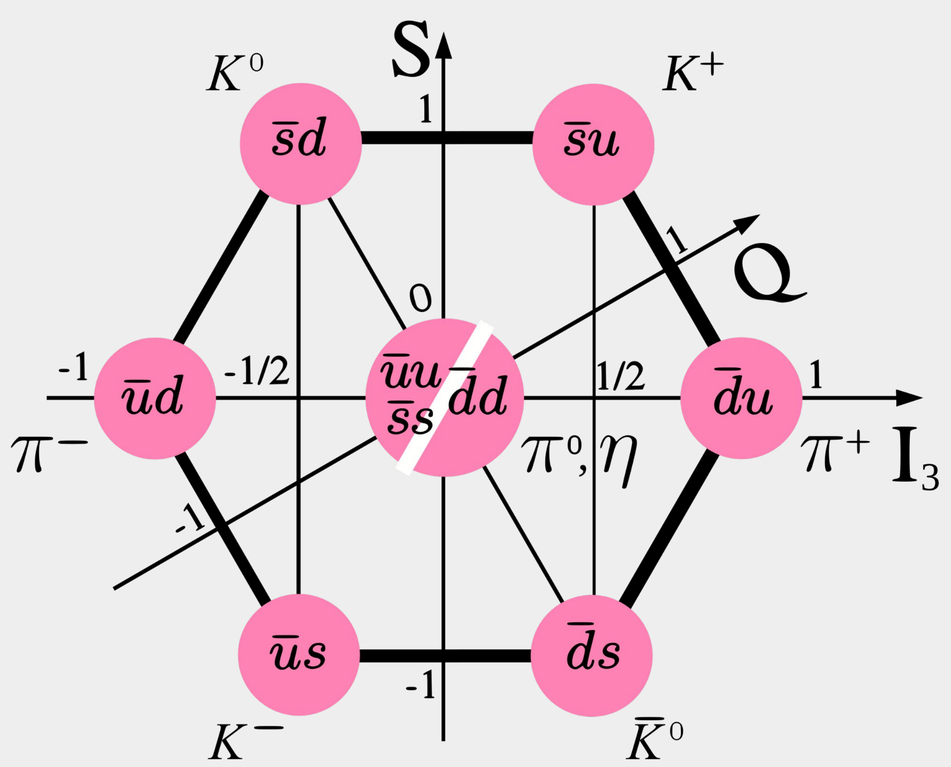
Internal Structure

- Two pole structure from SU(3) chiral dynamics
- Both poles contribute to the πΣ mass spectrum

$$\mathbf{8}_M \otimes \mathbf{8}_M = \mathbf{1} \oplus \mathbf{8} \oplus \mathbf{8} \oplus \mathbf{10} \oplus \overline{\mathbf{10}} \oplus \mathbf{27}$$

- The singlet and one of the octets become the two poles





Construction of states

- Construct the tensor product representation with C-G coefficients
- Choose the states that Have S = -1 and I = 0
- Calculate the contractions among these states
- In parallel we also construct the operators with tensor methods

$$\overline{\mathbf{3}} \otimes \mathbf{3} \otimes \mathbf{3} \otimes \mathbf{3} \otimes \mathbf{3}$$

Future work

- Use of distillation to obtain the correlation functions
- Extraction of the discrete energy spectrum
- Lüscher analysis for the extraction of the poles
- Move away from SU(3) point and study of change in pole location

References

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