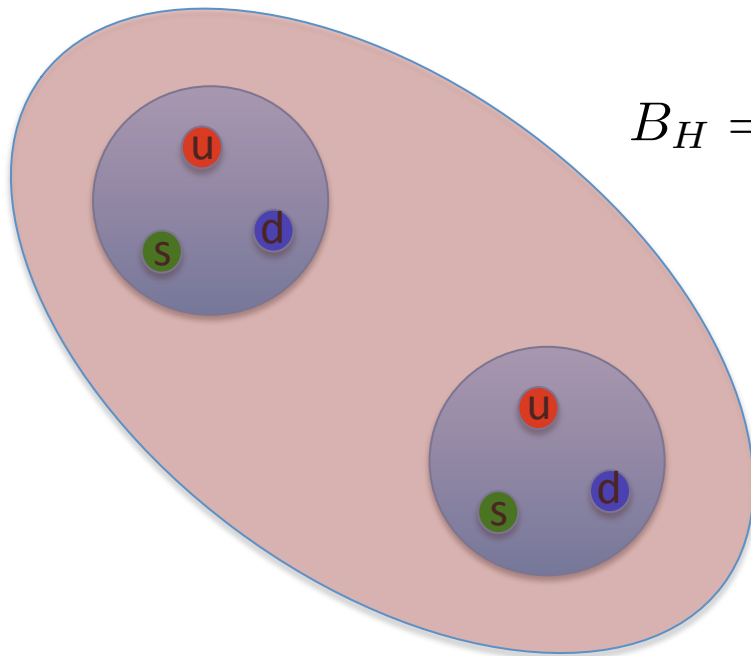


The first LQCD prediction for a bound two-body Hyperon system

Luu \subset NPLQCD

[Phys.Rev.Lett. 106 \(2011\) 162001](#)



$$B_H = 16.6 \pm 2.1 \pm 4.6 \text{ MeV} \quad @ \quad m_\pi = 389 \text{ MeV}$$

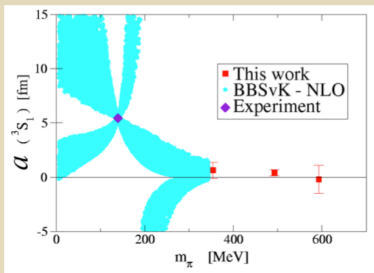
Second prediction by Japanese HALQCD collaboration corroborates our finding
([Phys.Rev.Lett. 106 \(2011\) 162002](#))

Does the bound state persist as $m_\pi \rightarrow 140 \text{ MeV}$?

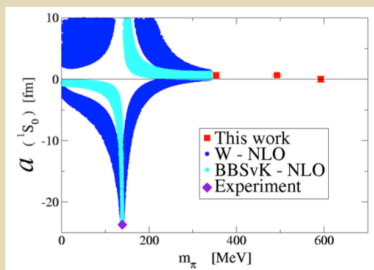
BBN constraints on allowed quark mass variations

Bedaque, *Luu*, Platter
[Phys.Rev. C83 \(2011\) 045803](#)

Using pionless EFT, lattice-constrained low-energy constants, and observed BBN abundances, we derive limits on allowed early universe quark mass variations



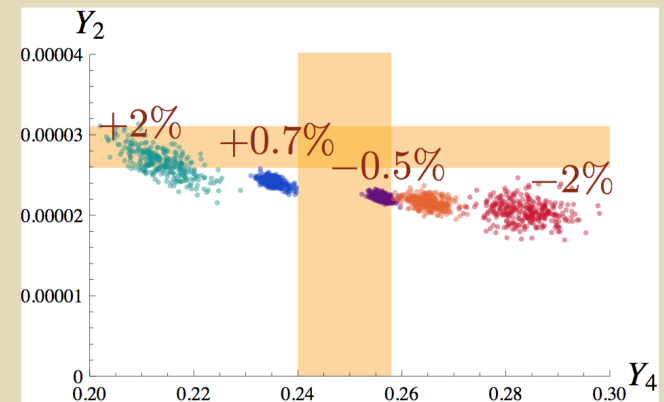
$$\frac{m_q}{B_2} \frac{dB_2}{dm_q} = -4.4 \pm 4.1$$



$$\frac{da_s}{dm_\pi} = -0.75 \pm 1.0 \frac{\text{fm}}{\text{MeV}}$$

Beane, P.B., Orginos, Savage (2006)

$$\eta_{10} = 6.23$$



$$\left| \frac{\Delta m_q}{m_q} \right| > 1\% \quad \text{excluded}$$

Explicit formulas relating continuum scattering phase shifts to cubic irreps

Luu & Savage

PRD *in press* [[arXiv:1101.3347](https://arxiv.org/abs/1101.3347)]

We derive the requisite formulas needed to extract $l > 0$ partial wave information from LQCD calculations

S-wave
“Luscher’s formula”
What was already known

$$q \cot \delta_0 = \frac{2}{\sqrt{\pi L}} Z_{0,0}(1; \tilde{q}^2)$$

A₁ irrep

Generalized
Zeta function

P-wave

$$q^3 \cot \delta_1 = \left(\frac{2\pi}{L}\right)^3 \frac{1}{\pi^{3/2}} \tilde{q}^2 Z_{0,0}(1; \tilde{q}^2)$$

T₁ irrep

D-wave

$$q^5 \cot \delta_2 = \left(\frac{2\pi}{L}\right)^5 \frac{1}{\pi^{3/2}} \left(\tilde{q}^4 Z_{0,0}(1; \tilde{q}^2) + \frac{6}{7} Z_{4,0}(1; \tilde{q}^2) \right)$$

E irrep

$$q^5 \cot \delta_2 = \left(\frac{2\pi}{L}\right)^5 \frac{1}{\pi^{3/2}} \left(\tilde{q}^4 Z_{0,0}(1; \tilde{q}^2) - \frac{4}{7} Z_{4,0}(1; \tilde{q}^2) \right)$$

T₂ irrep