

**Nuclear forces and their impact on structure,
reactions and astrophysics**

TALENT 2013

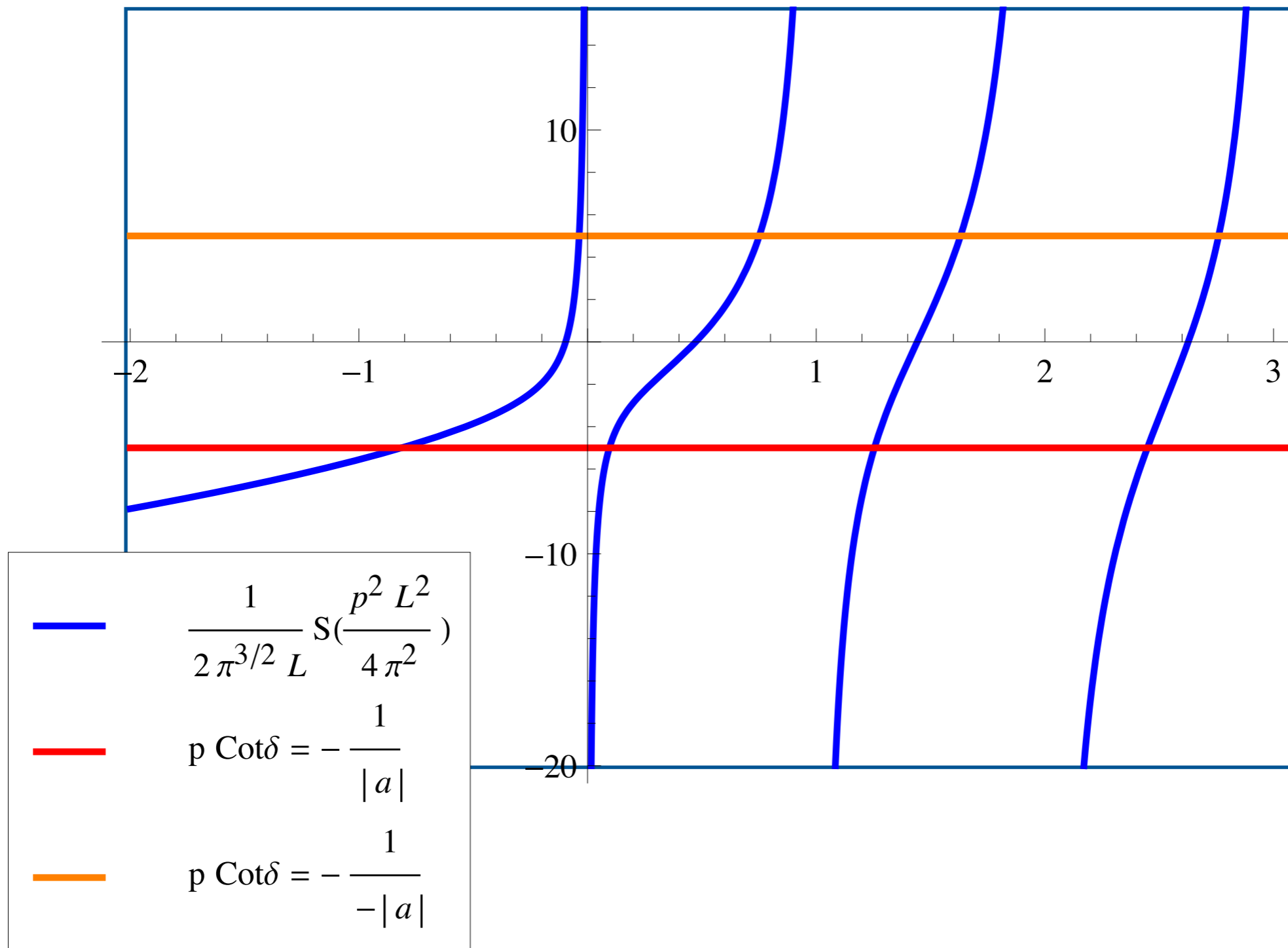
Lecture on

Nuclear Forces from Lattice QCD

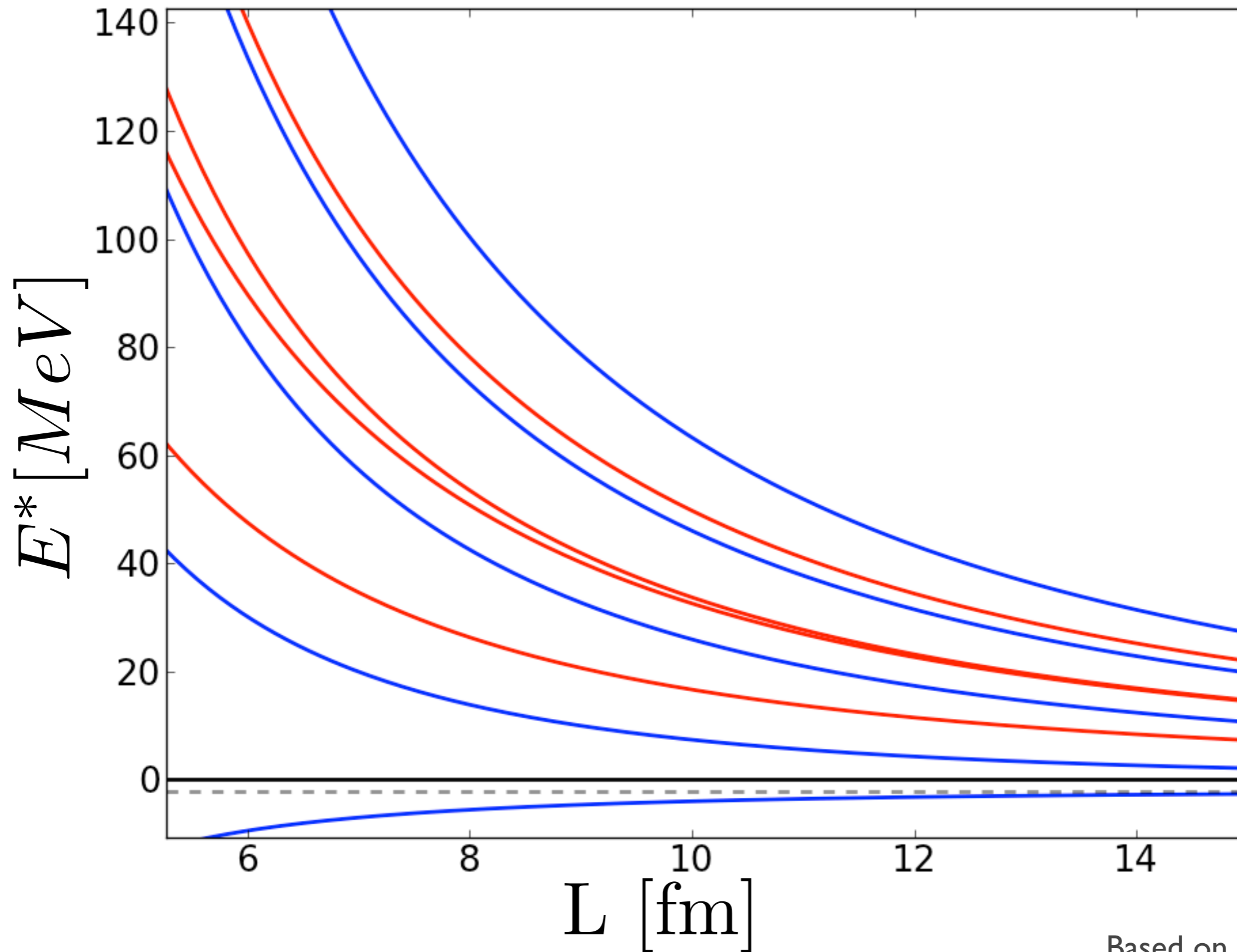
Zohreh Davoudi

University of Washington

S-wave Luescher formula - a demonstration



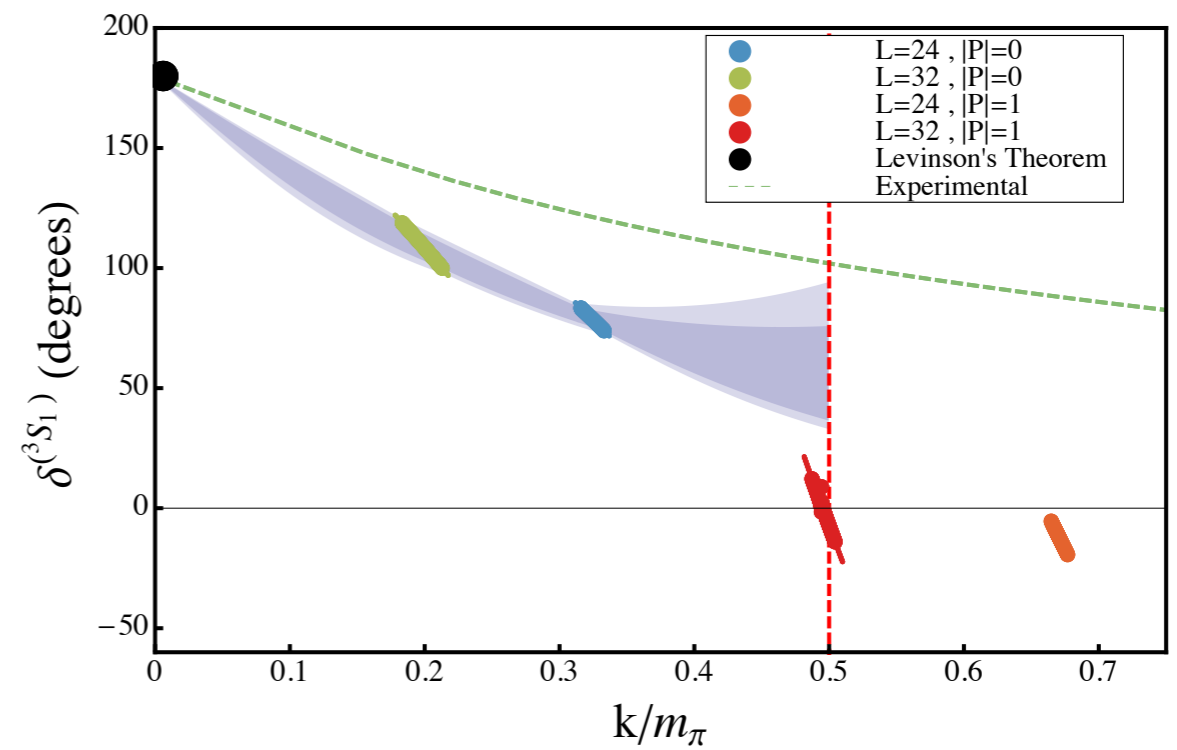
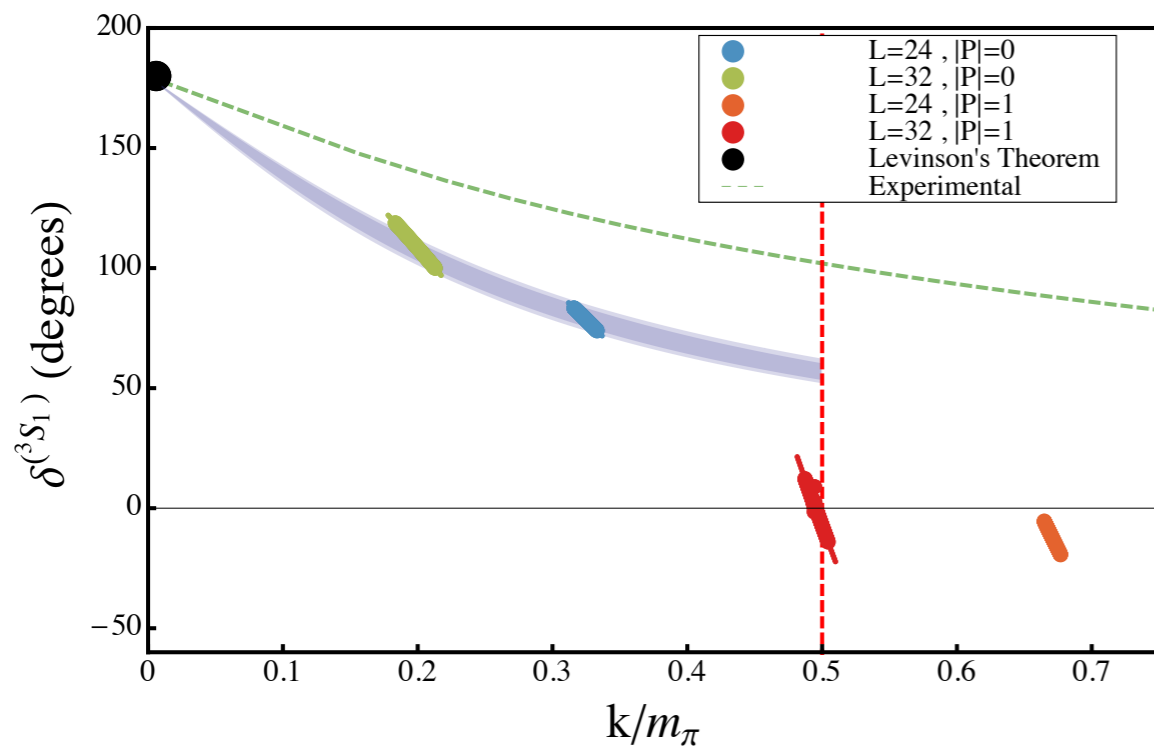
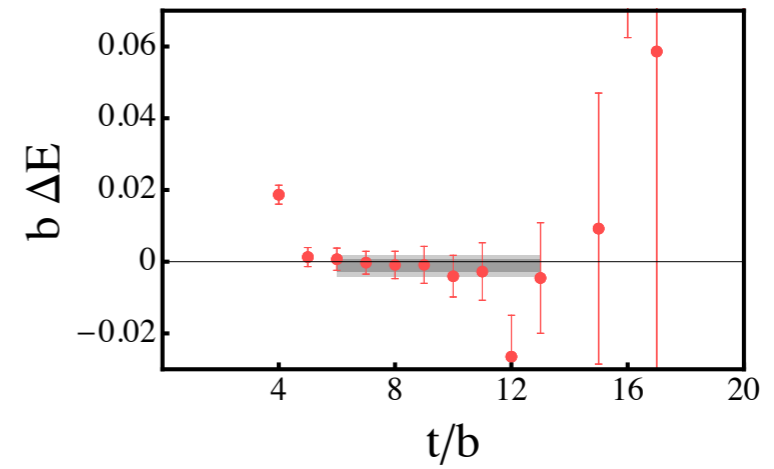
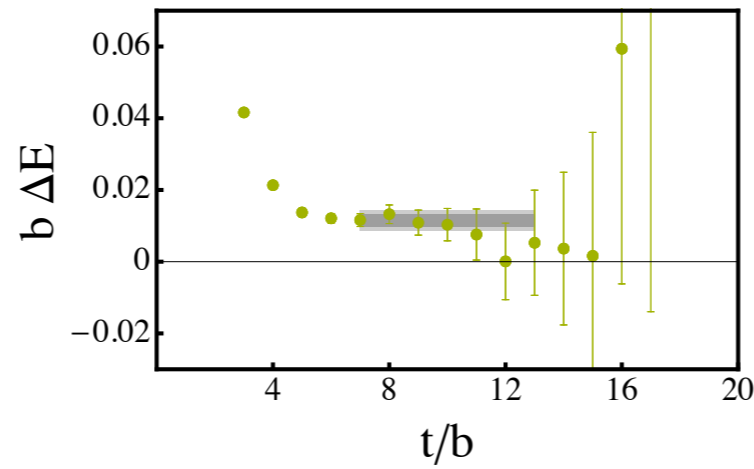
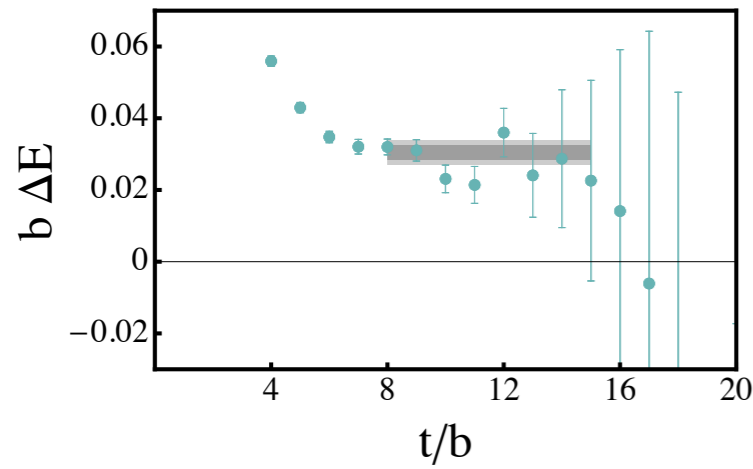
NN spectrum in coupled 3S1-3D1 channel



Based on hep-lat/1305.4903.

Nucleon-nucleon scattering

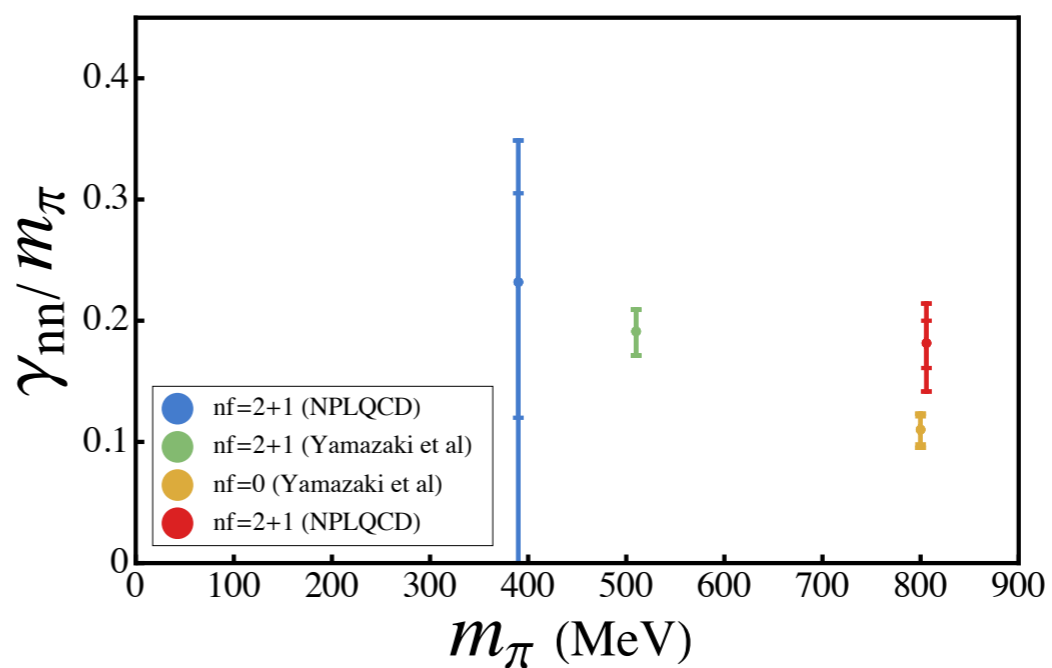
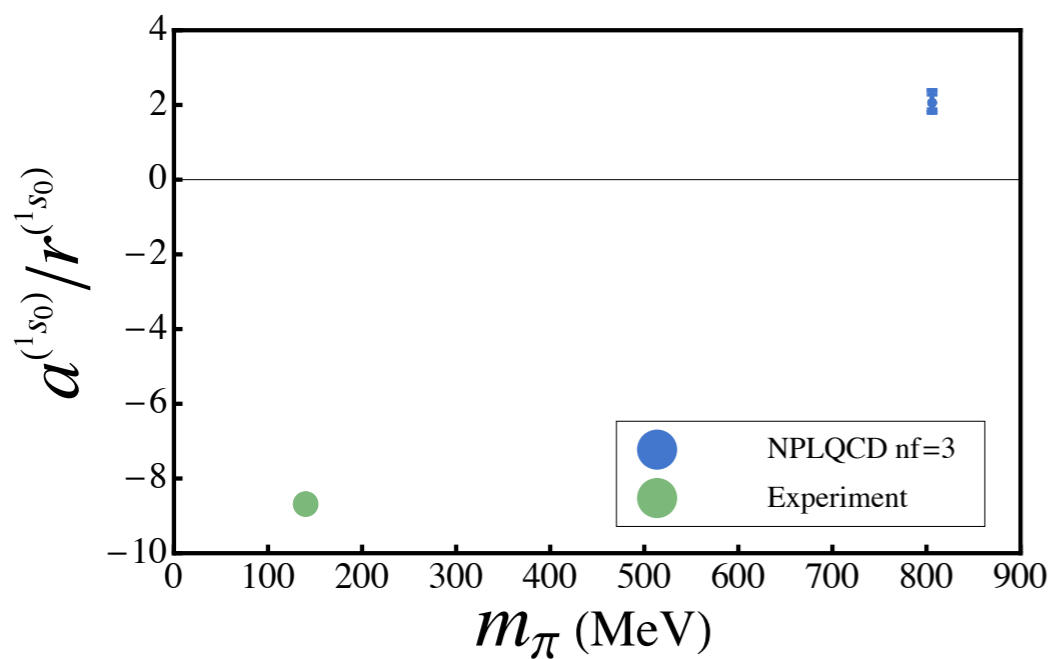
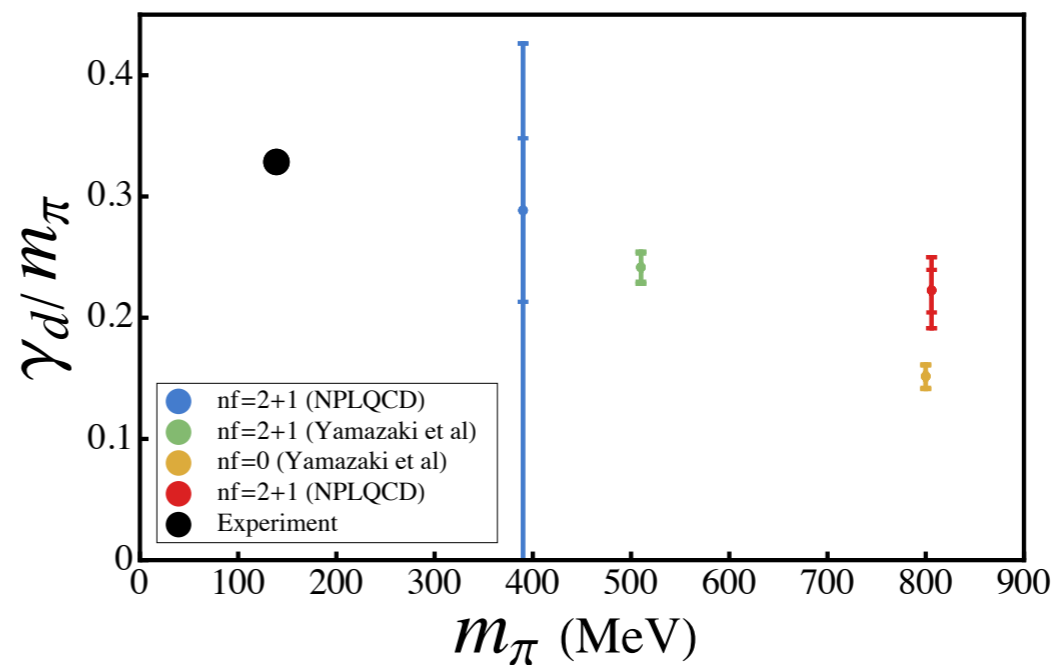
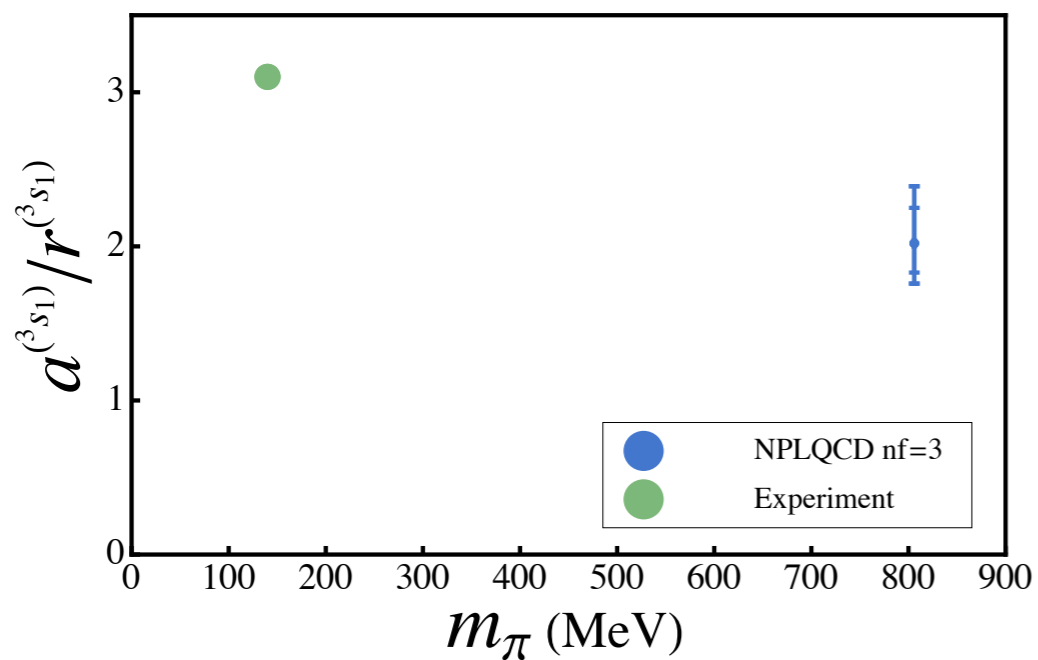
3S1 channel



$m_\pi \sim 800 \text{ MeV}$

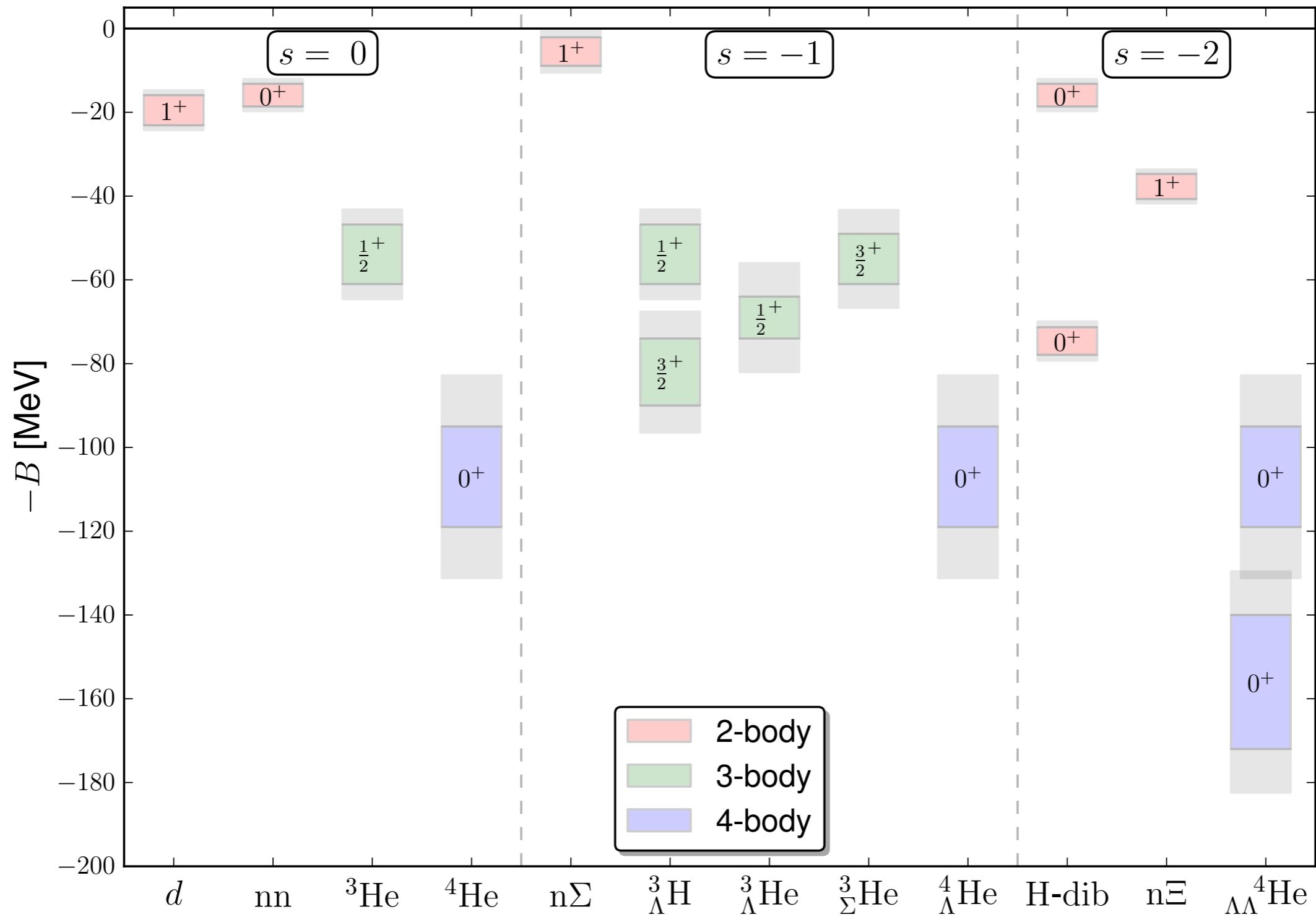
hep-lat/1301.5790v1.

Fine tuning and naturalness from LQCD?



hep-lat/1301.5790v1.

Multi-nucleon systems

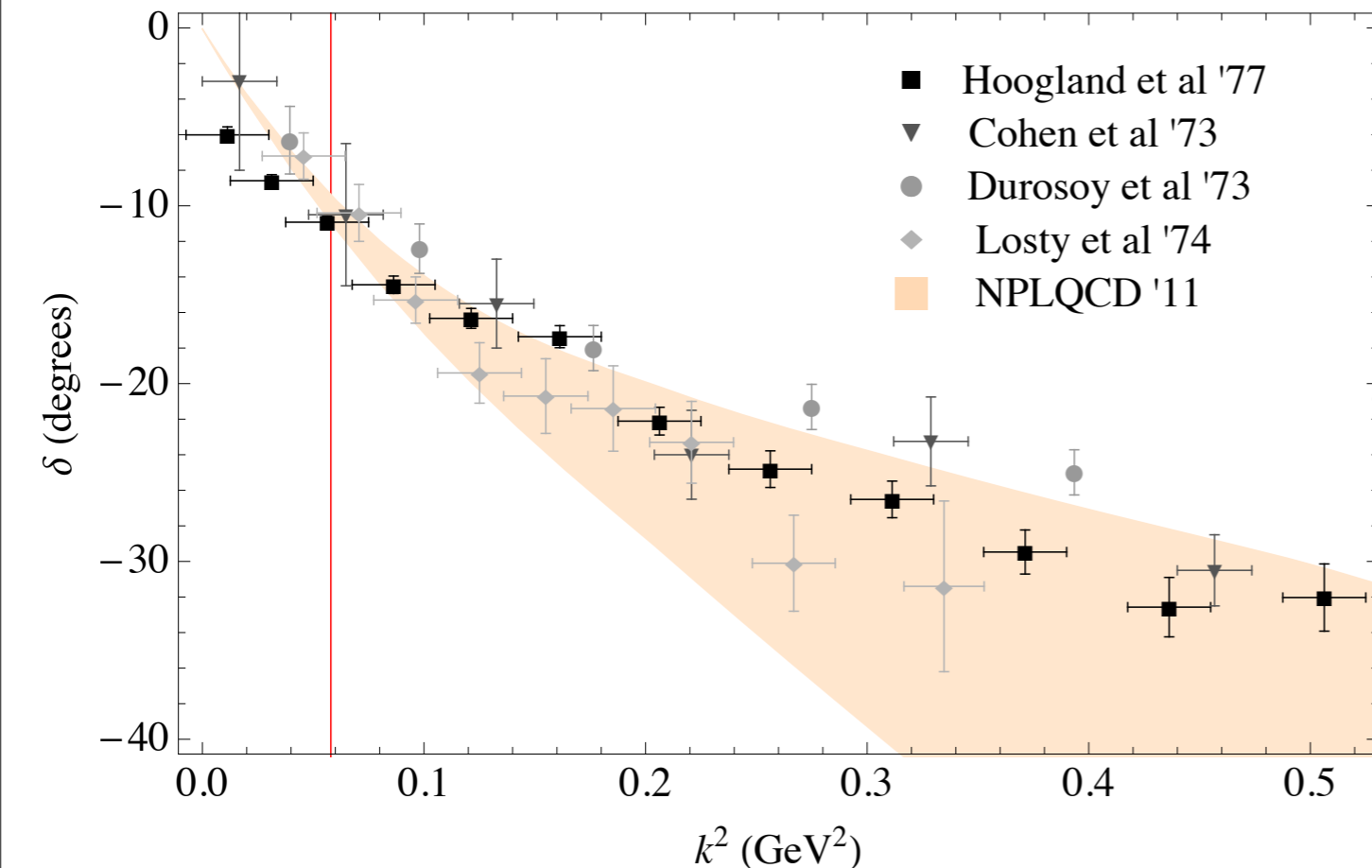
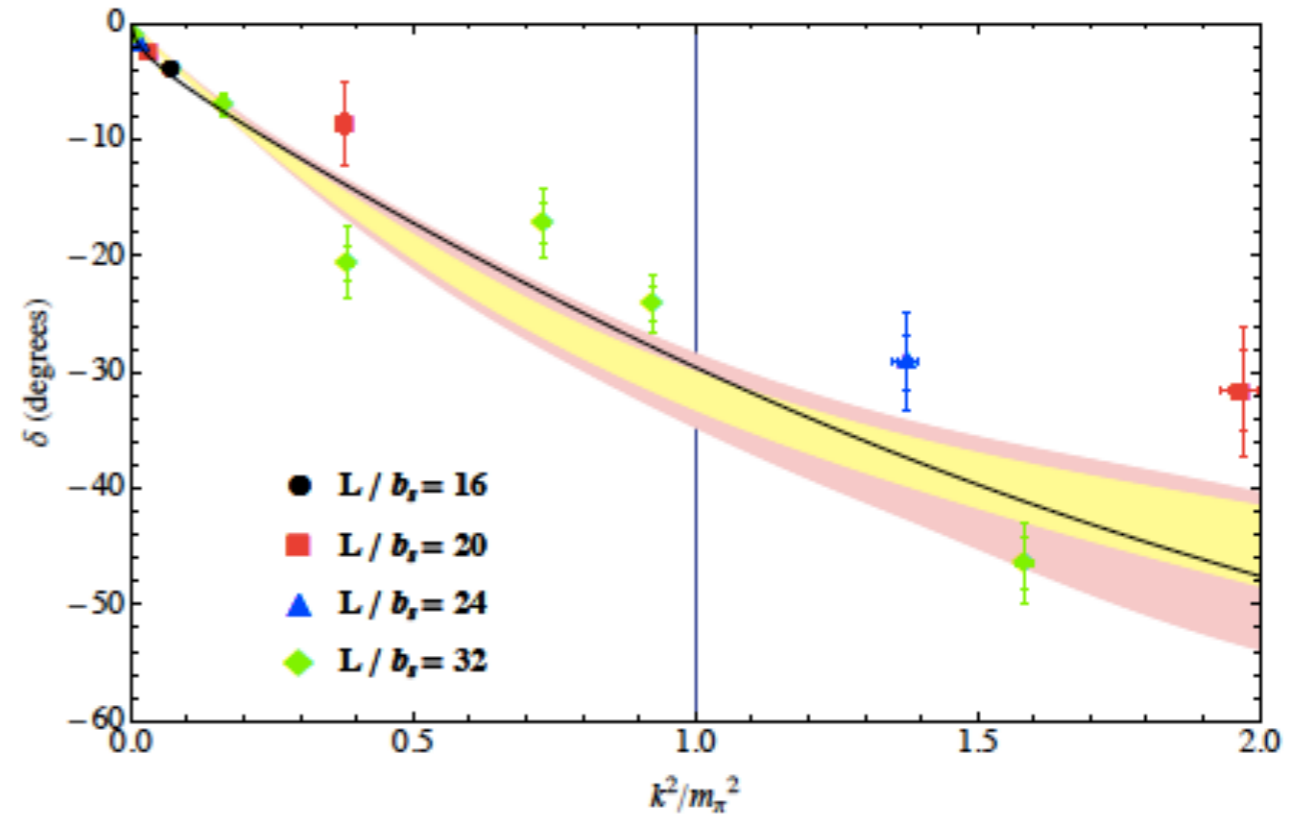
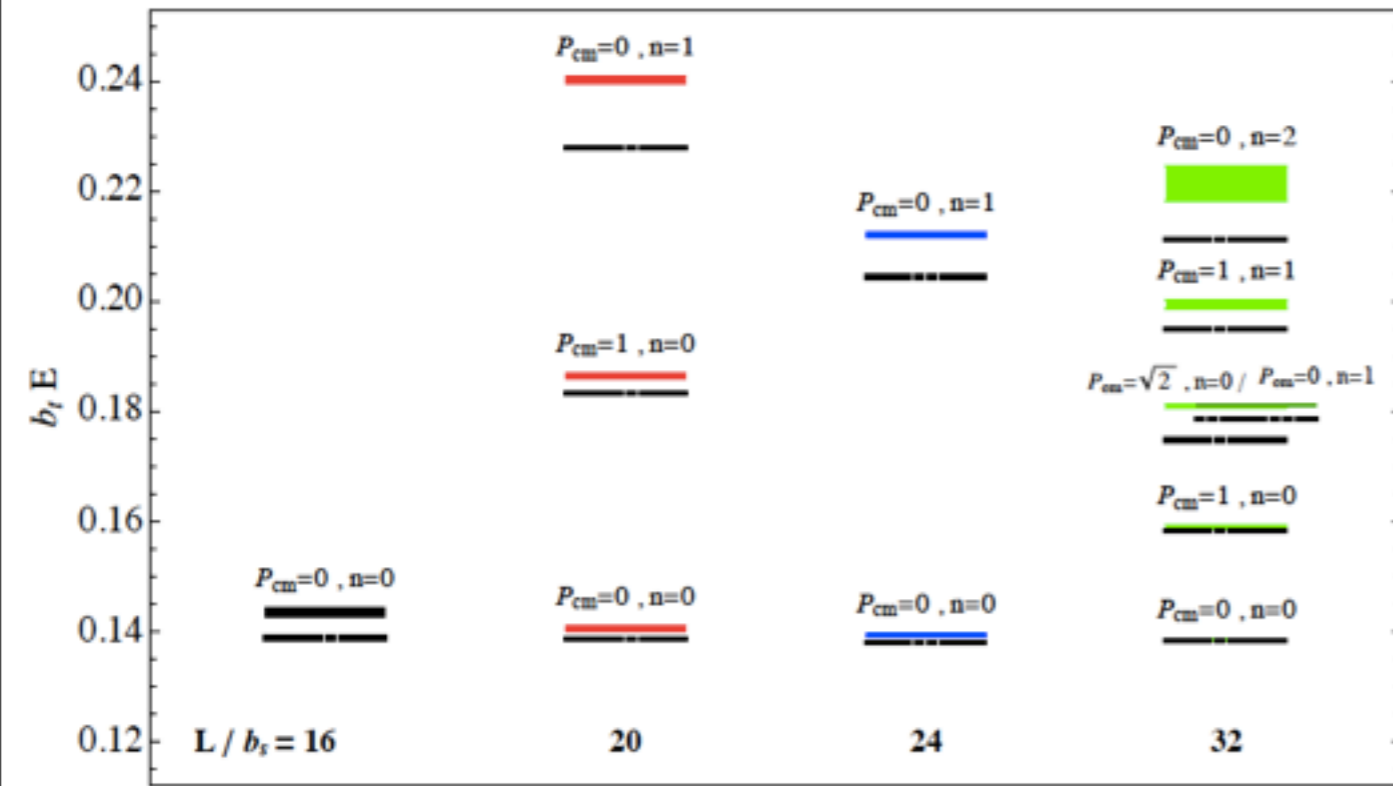


$m_{\pi} \sim 800 \text{ MeV}$



hep-lat/1206.5219v2, PRD 2013.

Pion-pion scattering phase shifts



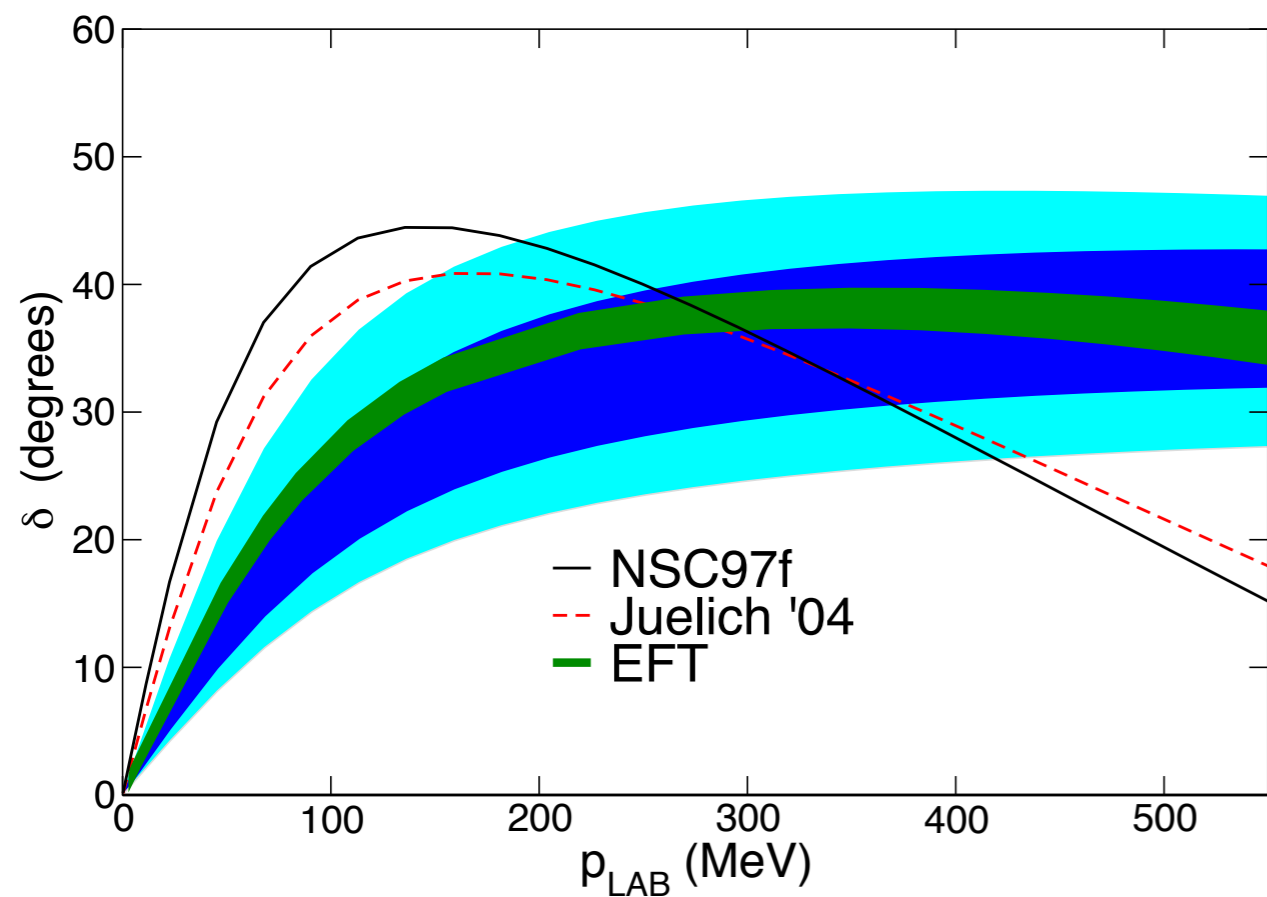
$\pi^+ \pi^+$ scattering
 $m_\pi \sim 390 \text{ MeV}$



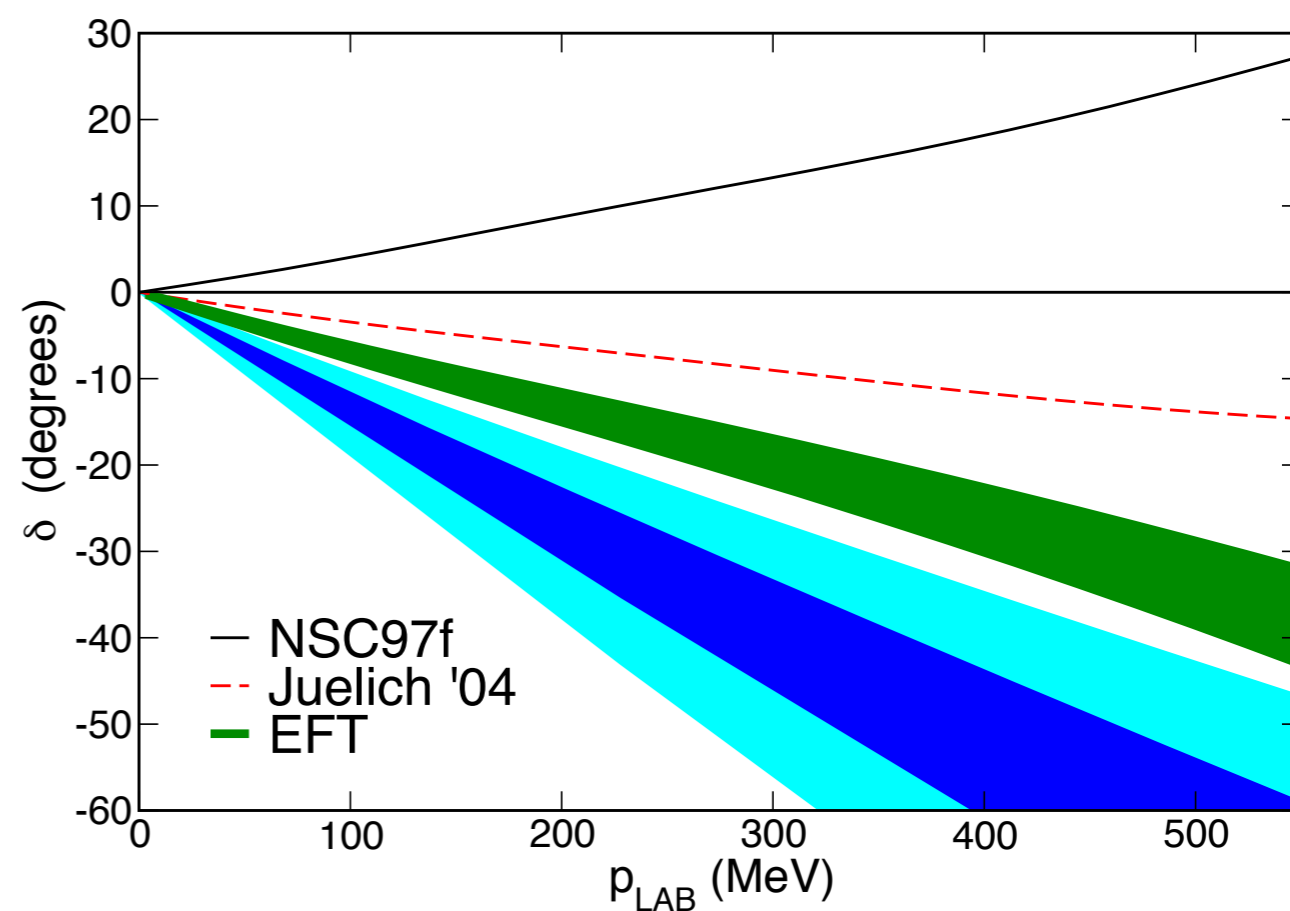
hep-lat/1107.5023v2, PRD 2012.

Hyperon-nucleon scattering

$^1S_0 \quad n\Sigma^-$



$^3S_1 \quad n\Sigma^-$



$m_\pi \sim 390 \text{ MeV}$



hep-lat/1204.3606, PRL 2012.