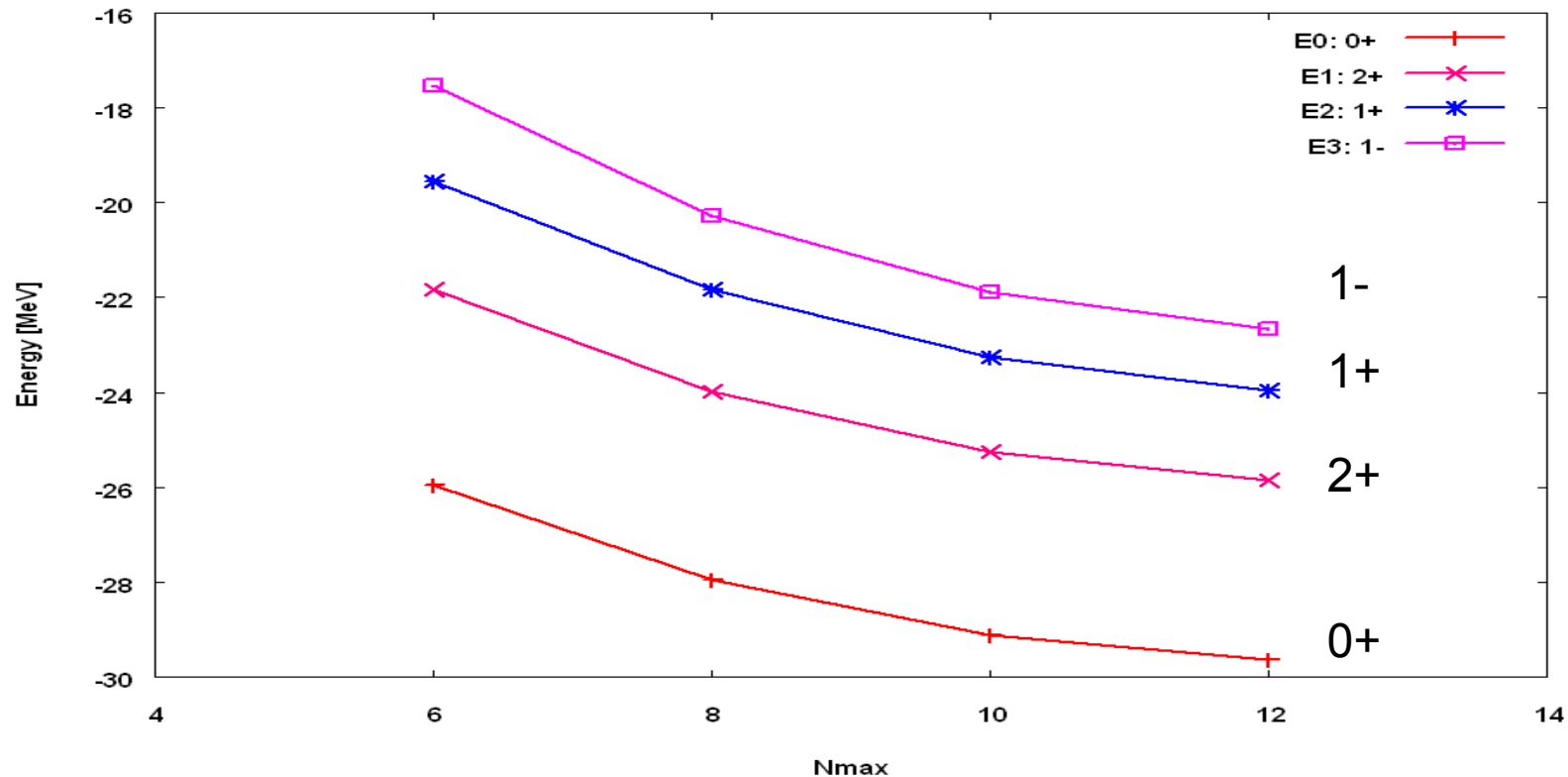


# He 8: Nmax=12 (Importance Truncated)

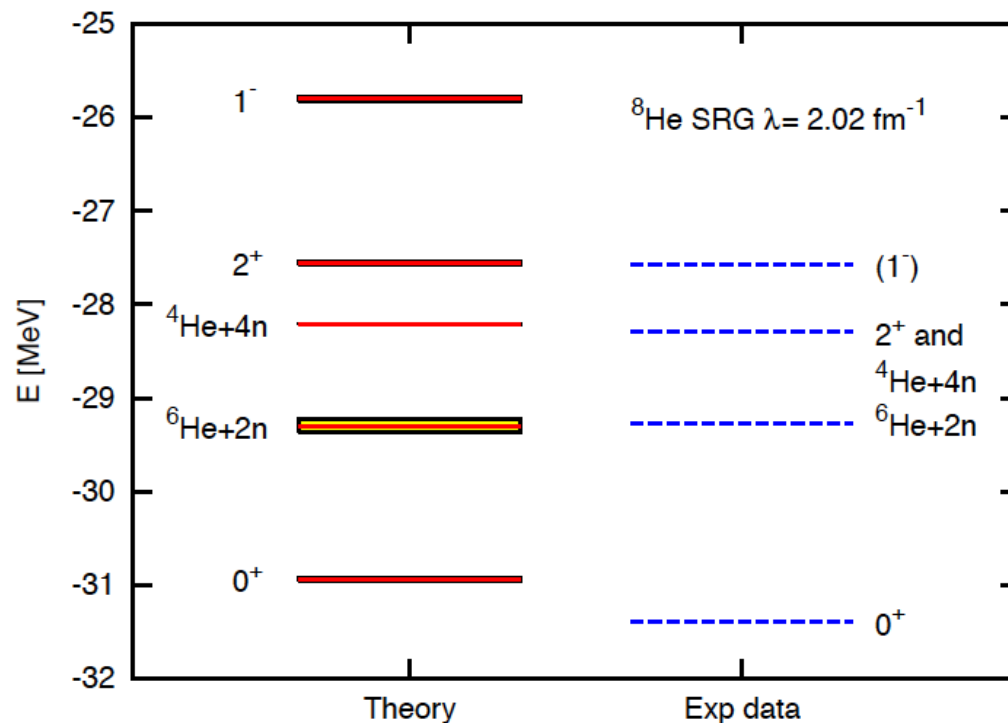


Nmax	E0 (MeV)	E1 (MeV)	E2 (MeV)	E3 (MeV)
12	-29.604	-25.854	-23.951	-22.664

Nmax	Full space (+) Parity	IT space (k=1E-5)
12	~ 428 million	~ 13.65 million

# SRG-tuning of NN interaction

- We use the chiral N3LO NN interaction (500 MeV/c)
- SRG transformed to  $\lambda = 2.02 \text{ fm}^{-1}$ .
- How well do you describe other He isotopes then?



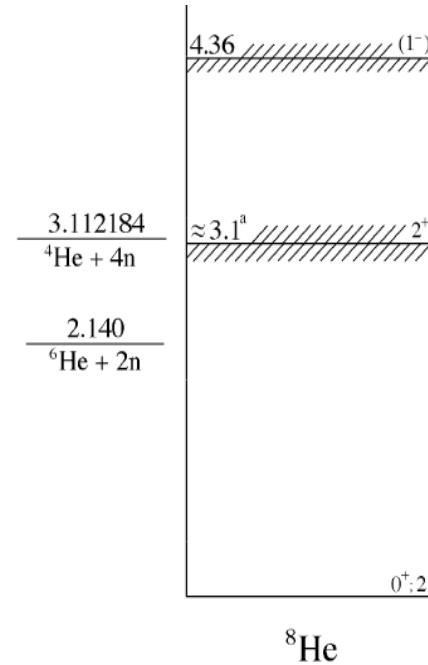
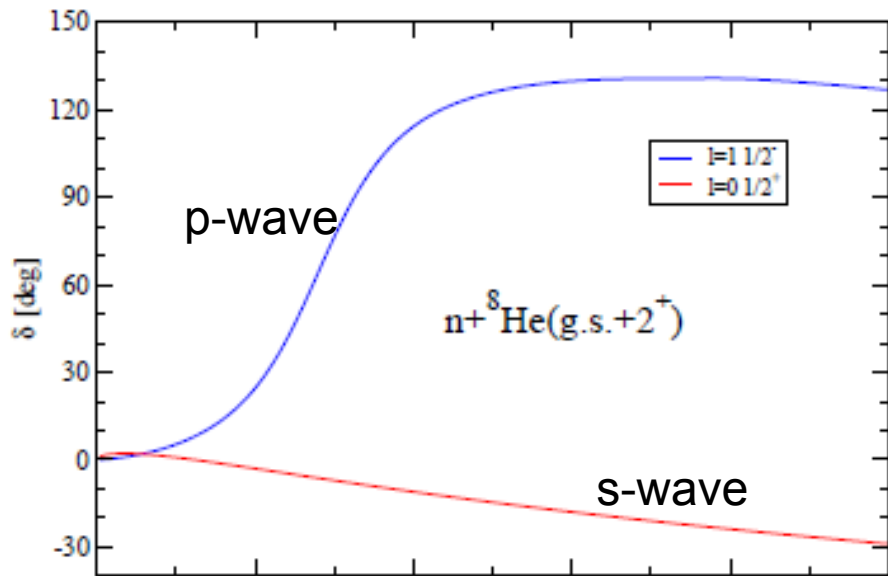
Performed NCSM calculations for He-6 and He-4 using same interaction and HO = 16 MeV.

Note: These results are extrapolations to  $N_{\text{max}}$  infinity.

We find that  $\lambda = 2.02 \text{ fm}^{-1}$  tunes the NN interaction in such a way as to accurately reproduce exp.

Compares well to S. Bacca Phys. Rev. C 86, 034321 (2012)

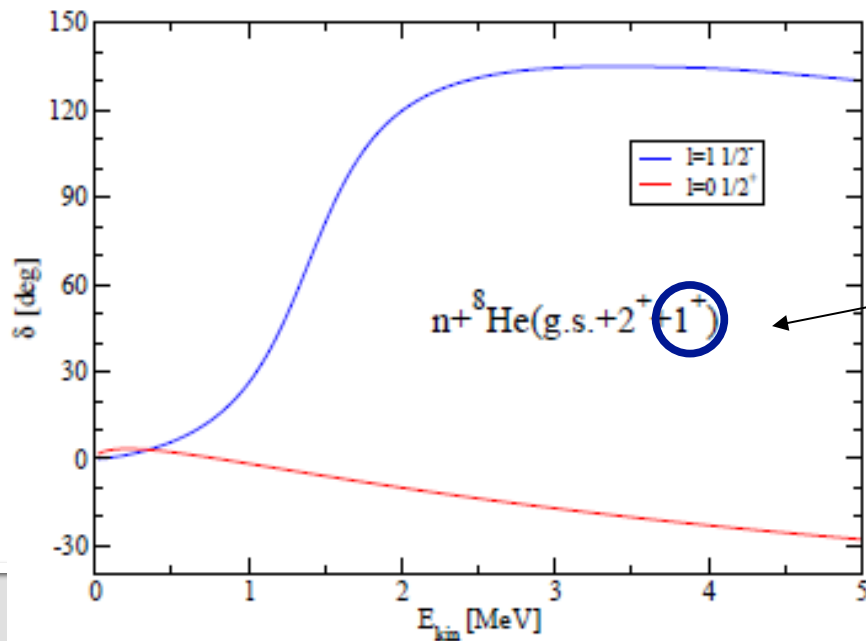
# NCSM/RGM: Inclusion of various states



(1-) state: 4.36 MeV

2+ state: 3.1 MeV

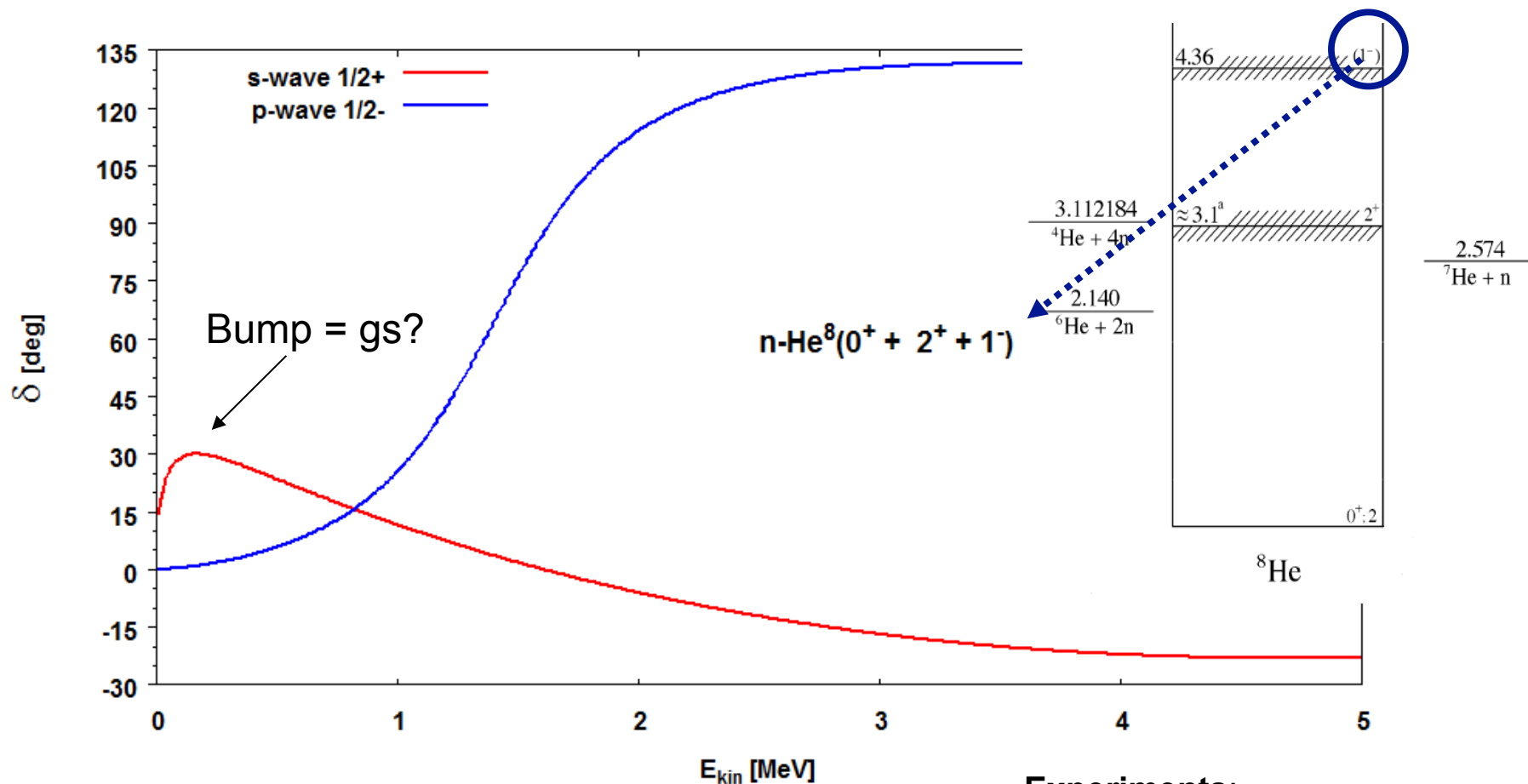
0+ state



There is almost no difference in the calculated phase shifts for including the  $1^-$  state as well. Scattering length  $a_0 = -1$  fm.

No bound state.

# NCSM/RGM: Inclusion of negative parity state

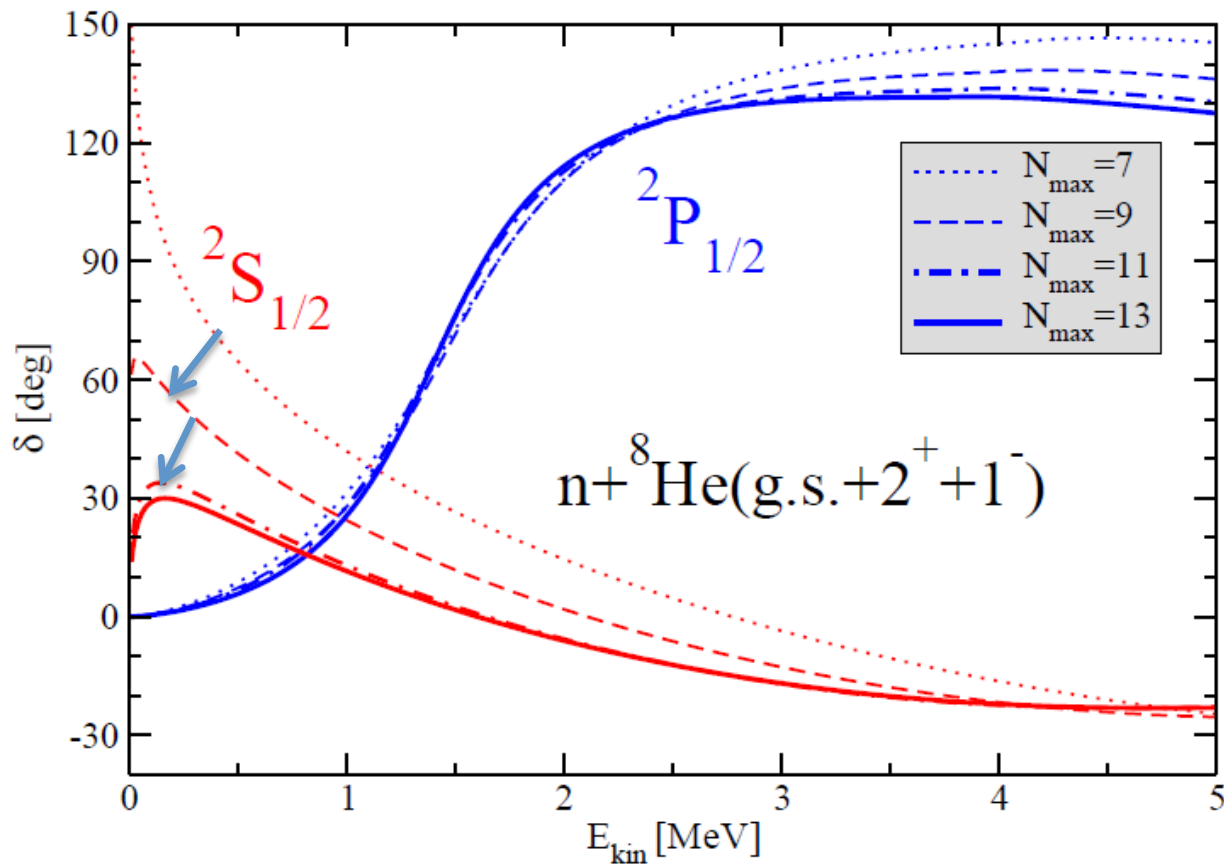


The inclusion of the negative parity state has a large effect! Now the predicted scattering length is  $a_0 = -12.59$  fm.

## Experiments:

- $a_0 < -10$  fm (Chen et al.) [PLB 505, 2001]
- $a_0 \sim -3$  fm (Al Falou, et al.) [arxiv:nucl-ex: 1008:0543]

# Convergence check: Nmax



Use the full NCSM basis for  $N_{\text{max}} = 7 - 11$ .

$N_{\text{max}} = 13$  has IT-NCSM wavefunctions.

Convergence of s-wave seems ok.

Convergence of p-wave is very good up to 2.5 MeV.