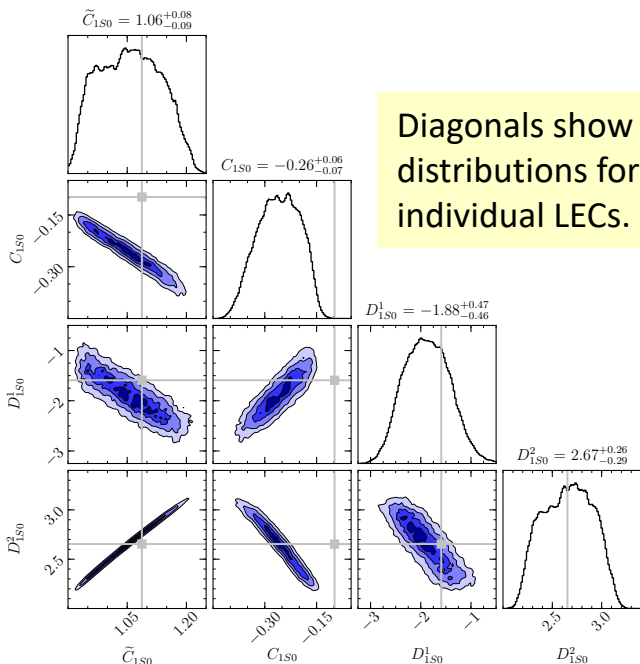


Objectives

- Develop statistical tools to provide theoretical error bars *and* to assist in scientific discovery.

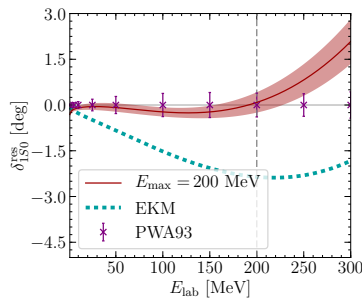
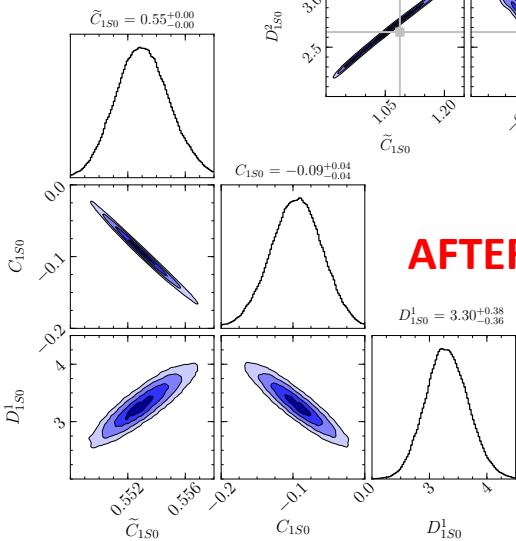
BEFORE

Off-diagonals show correlations for pairs of LECs.



Diagonals show distributions for individual LECs.

AFTER



Impact

- Bayesian methods were adapted to parameter estimation for chiral effective field theories (EFTs).
- A spin-off from the visualization of parameter probabilities was the identification of a model redundancy that led to additional parameters *and* overfitting. This was unnoticed for over ten years.
- Removing redundancies resulted in new improved fits to experimental data with fewer parameters (see Reinert et al., Eur. Phys. J. **A54** (2018) 86).

Accomplishments

- Publication: S. Wesolowski, R.J. Furnstahl, J. Melendez, and Daniel Phillips, J. Phys. G **46**, 045102 (2019).
- Over 100 downloads in first two months online.

Figures: Probabilities density plots for 1S_0 EFT low-energy constants (LECs), which characterize the theoretical model. The top plot shows irregular behavior that suggested a parameter redundancy. After it was identified and removed, the lower plots (with one fewer parameter) show regular behavior and improved residuals with experiment.