

Abstract Submitted  
for the OSS13 Meeting of  
The American Physical Society

**Pion-pion scattering in  $\chi\text{PT}_S$**  ARBIN THAPALIYA, DANIEL PHILLIPS, Ohio University — Starting from a version of the SU(2) chiral  $\chi\text{PT}$  Lagrangian that includes an explicit scalar-isoscalar field [1], we construct the amplitude for  $\pi\pi$  scattering from threshold through the energies at which the  $\sigma$  resonance affects the phase shifts. We exhibit a power counting which mandates the resummation of the one-loop self-energy of the scalar field to all orders in the s-channel. We employ a Dyson equation for this purpose and discuss the associated renormalization of the scalar field's mass parameter and field strength. We also display the prediction for the decay width of the resonance. The full  $\pi\pi$  LO amplitude in the region of interest then includes the resonant s-channel amplitude, combined with t- and u-channel exchanges of the scalar and the standard LO  $\chi\text{PT}$  contact term. At threshold, the presence of the additional degree of freedom modifies the  $\chi\text{PT}$  prediction for the  $\pi\pi$  scattering lengths [1]. We perform a partial-wave decomposition of this amplitude, identify the phase shifts in the kinematic domain up to the resonance peak, and compare them to recent accurate data for the s-wave isoscalar  $\pi\pi$  phase shifts.

[1] J. Soto, P. Talavera and J. Tarrus, Nucl. Phys. B **866**, 270 (2013).

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Date submitted: 28 Feb 2013

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