Abstract Submitted
for the 4CF09 Meeting of
The American Physical Society

Lattice Computation of Nucleon Strangeness WALTER FREEMAN, DOUGLAS TOUSSAINT, University of Arizona, MILC COLLABORATION — The matrix element $\langle N|s\bar{s}|N\rangle$, the "nucleon strangeness," is of interest to the general understanding of hadronic physics, as it gives the amount by which the presence of a nucleon disturbs the vacuum strange quark condensate. Moreover, knowledge of this quantity is also mportant to the interpretation of proposed dark matter detection experiments, since many dark matter scenarios have a large contribution to the scattering cross-section from Higgs exchange with heavy quarks in nuclear matter. Due to the extreme difficulty of measuring it experimentally, it must be calculated from first principles using lattice QCD, but previous calculations have produced inconsistent or imprecise results. Using the Feynman-Hellman theorem, we relate the matrix element in question to the derivative $\frac{\partial M_N}{\partial m_s}$. We then evaluate this derivative by analyzing the existing library of MILC gauge configurations and hadron propagators, and thus determine $\langle N|s\bar{s}|N\rangle$ to greater precision than previously possible. We have evaluated this quantity at a variety of light quark masses and lattice spacings and extrapolate to the physical point; at the physical point, $\frac{\partial M_N}{\partial m_s} = 0.69(7)_{stat}(9)_{sys}$ in the $\overline{MS}(2GeV)$ regularization. We are currently working on a technique to further reduce these errors by partitioning the lattice and only considering the quark condensate in the relevant fraction, but this requires recalculation of hadron propagators which is ongoing.

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Date submitted: 25 Sep 2009

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