function, and serves to precisely cancel the non-local divergence that appears in the bare non-diagonal correlation function. The renormalized non-diagonal correlation function is free of divergences, as it must be. This represents the perturbative contribution to the OPE of the non-diagonal correlation function (6.3), and hence represents purely perturbative contributions to the mixing between scalar mesons and gluonia.

The research presented in this chapter emphasizes the renormalization methodology used in QSR analyses. In particular, the composite local operators used to represent currents that probe hadronic states can mix under renormalization. Divergent terms that appear at leading order in the expansion of Wilson coefficients cannot be renormalized multiplicatively and hence must be due to operator mixing. Conversely, when divergent terms appear in higher order terms in the Wilson coefficients, such as in Chapter (4) they can be removed through a multiplicative renormalization. In both cases renormalization-induced contributions are generated and must be included. The loop integration techniques developed in Chapter 2 are needed in order to perform these calculations. In addition, the techniques used here have been extended to investigate mixing effects among the heavy quarkonium-like states [32].

6.3 Published Article

The scalar glueball and quark meson mixing paper was published in Nuclear Physics A in 2011. Links to the preprint and published journal versions are included below.

- D. Harnett, R.T. Kleiv, K. Moats and T.G. Steele, Near-maximal mixing of scalar gluonium and quark mesons: a Gaussian sum-rule analysis, Nucl. Phys. A850 (2011) 110, arXiv:0804.2195 [hep-ph].