List of Figures

1.1 Schematic representation of deep inelastic scattering. 6
1.2 A ($2 \longrightarrow 2$) scattering process. 13
1.3 An interaction of two particles via the exchange of a Reggeon. 13
1.4 Plot of particle mass squared (in GeV^2) versus spin (in units of $\hbar$) . . . 14
1.5 Leading Order splitting functions diagrams. 17
1.6 Examples of next-to-leading Order splitting functions diagrams. 18
1.7 Schematic representation of the applicability of various QCD evolution equations across the $x - Q^2$ plane. 19
1.8 The contribution from target mass corrections(TMC) to F_2^{NS} structure function. Figure is taken from[50]. 25
1.9 Examples of higher twist QCD diagrams. 26
1.10 x dependence of the ratio $R^A_{F_2}(x, Q^2)$ for a given fixed Q^2. 28

2.1 Schematic diagram of the NMC spectrometer. 31
2.2 NMC measurements[63] of F_2^{NS} structure function along with BCDMS data. (Fig. taken from [80].) 32
2.3 NMC measurements of Gottfried sum rule[65]. 33
2.4 Schematic diagram of the CCFR Dtector. 33
2.5 CCFR measurements of xF_3 structure function[66]. 34
2.6 CCFR measurements of GLS sum rule as a function of x[67]. 35
2.7 CCFR measurements of GLS sum rule as a function of Q^2[67] 35
2.8 xF_3 structure function measured by NuTeV[68], CCFR[66] and CDHSW[69]. 36
2.9 Schematic diagram of the CHORUS detector. 37
2.10 CHORUS measurements of xF_3 structure function along with CCFR and CDHSW data. 38
2.11 Schematic diagram of the Spin Muon Collaboration spectrometer. . . . 39
2.12 Schematic diagram of the COMPASS spectrometer. 41

2.13 Spin-dependent non-singlet structure function xg_1^{NS}, measured by various experimental collaborations. 41
2.14 Experimental results for Bjorken Sum Rule.(Q^2's are taken in the unit of GeV^2). 42
2.15 Schematic diagram of the HERMES spectrometer. 43

3.1 Our best fit results of Eq.(3.24) for $F_2^{NS}(x,Q^2)$ structure functions to NMC[63] results. 60
3.2 Our best fit results of Eq.(3.24) for $xF_3(x,Q^2)$ structure functions to CCFR[66] results. 61
3.3 Our best fit results of Eq.(3.24) for $xg_1^{NS}(x,Q^2)$ structure functions to the experimental data 62

4.1 Q^2 evolution of $F_2^{NS}(x,Q^2)$ structure functions in accord with (4.31)-(4.33) in comparison with NMC[63] and NNPDF[101] results. 75
4.2 x evolution of $F_2^{NS}(x,Q^2)$ structure functions in accord with (4.31)-(4.33) in comparison with NMC[63] results. 76
4.3 Q^2(in the unit of GeV^2) evolution of $F_2^{NS}(x,Q^2)$ structure functions in accord with (4.49)-(4.51) in comparison with NMC[63] results. 76
4.4 x evolution of $F_2^{NS}(x,Q^2)$ structure functions in accord with (4.49)-(4.51) in comparison with NMC[63] and NNPDF[101] results. 77
4.5 Q^2 evolution of $F_2^{NS}(x,Q^2)$ structure functions in accord with (4.33) and (4.51) in comparison with NMC[63] and NNPDF[101] results. . . . 77
4.6 x evolution of $F_2^{NS}(x,Q^2)$ structure functions in accord with (4.33) and (4.51) in comparison with NMC[63] results. 78
4.7 Q^2 evolution of $F_2^{NS}(x,Q^2)$ structure functions in accord with NNLO corrections, (4.33) and (4.51) in comparison with NMC[63] results. . . . 78

5.1 Q^2 evolution of $xF_3(x,Q^2)$ structure functions in accord with (5.31)-(5.33) 91
5.2 Q^2 evolution of $xF_3(x,Q^2)$ structure functions in accord with (5.31)-(5.33) 91
5.3 x evolution of $xF_3(x,Q^2)$ structure functions in accord with (5.31)-(5.33) 92
5.4 x evolution of $xF_3(x,Q^2)$ structure functions in accord with (5.31)-(5.33) 92
5.5 Q^2 evolution of $xF_3(x,Q^2)$ structure functions in accord with (5.49)-(5.51 93
5.6 Q^2 evolution of $xF_3(x,Q^2)$ structure functions in accord with (5.49)-(5.51) 94
5.7 x evolution of $xF_3(x,Q^2)$ structure functions in accord with (5.49)-(5.51) 94
5.8 x evolution of $xF_3(x,Q^2)$ structure functions in accord with (5.49)-(5.51) 95

5.9 Q^2 evolution of $xF_3(x,Q^2)$ structure functions in accord with (5.33) and (5.51) 96
5.10 Q^2 evolution of $xF_3(x,Q^2)$ structure functions in accord with (5.33) and (5.51) 96
5.11 NNLO results for $xF_3(x,Q^2)$ structure functions predicted by(5.51) along with the uncertainty band associated with 97

6.1 xg_1^{NS} structure function in accord with (6.24)-(6.26), compared with the data taken from 108
6.2 xg_1^{NS} structure function in accord with (6.38)-(6.40), compared with the data taken from 109
6.3 xg_1^{NS} structure function in accord with (6.26) and (6.40) and in comparison with the data taken from 110
6.4 xg_1^{NS} structure function in accord with (6.40)and in comparison with different experimental data and theoretical as well as 111

7.1 General interpretation of sum rule. The curve represents the variation of the structure function F_i^{NS} with x 115
7.2 LO, NLO and NNLO results for GSR along with parton model and pQCD predictions. 119
7.3 Our NNLO results for GSR in comparison with parton model and NNLO pQCD predictions as well as the results of NNPDF collaboration. 119
7.4 GSR as a function of x_{min} in comparison with NMC, NNPDF and KMRS results. The uncertainty band shown here is the uncertainty associated with the iput point. 120
7.5 Results for the Gross - Llewellyn Smith sum rule at LO, NLO and NNLO, as a function of Q^2. 123
7.6 Our NNLO results for the Gross-Llewellyn Smith sum rule, for various values of Q^2, along with QCD predictions 124
7.7 Results for the Gross-Llewellyn Smith sum rule, for various values of x. The data are taken from the CCFR experiment [67]. 124
7.8 The results of Bjorken integral as a function of the low x limit of integration, x_{min}, in LO, NLO and NNLO 127
7.9 The results of Bjorken integral as a function of momentum transfer squared Q^2 in LO, NLO and NNLO 127

7.10 Our results of Bjorken integral in comparison with the QCD predictions up to NNLO[39]. 128

8.1 Our NNLO results for F_2^{NS} structure function with and without nuclear effect, in comparison with the NMC measurement. 139
8.2 Our NNLO results for xF_3 structure function with and without nuclear effect, in comparison with the CCFR data. 140
8.3 Our NNLO results for xg_1^{NS} structure function with and without nuclear effect, in comparison with SMC, HERMES, COMPASS and E143 data. 141
8.4 Our NNLO results for Gross-Llewelln Smith sum rule with and without nuclear effect, in comparison with those of CCFR measurements. 145
8.5 Our NNLO results for Bjorken sum rule with and without nuclear effect, in comparison with several experimental data as indicated in the figure. 145

9.1 Higher twist corrections to F_2^{NS} structure function at NNLO. (Q^2's are taken in the unit of GeV^2). 153
9.2 Higher twist corrections to xF_3^{NS} structure function at NNLO. (Q^2's are taken in the unit of GeV^2). 155
9.3 Hgher Twist corrections to GLS sum rule at NNLO. (Q^2's are taken in the unit of GeV^2). 156
9.4 Hgher Twist corrections to BSR at NNLO. (Q^2's are taken in the unit of GeV^2). 157