

Contents

1	Inflation minimally coupled to gravity	1
2	Inflation with Non-Minimal coupling to gravity and CMB fluctuation	5
2.1	Conformal transformation	6
2.2	New field and potential	7
2.3	Slow roll parameters and COBE normalization	8
3	Radiative corrections	10
3.1	Corrections induced by the SM fields coupled to the Higgs field	10
3.2	Renormalization group of the SM with non-minimal coupling	13
3.3	Numerical results	15
3.4	2-loop corrections to the effective potential	18
3.5	1-loop versus 2-loop	22
4	Self-consistency of Higgs inflation	25
4.1	The cutoff scale revisited	27
4.2	Computation of the cutoff due to graviton exchange	28
4.3	Cutoff in the Jordan frame	29
4.4	Cutoff in the Einstein frame	32
4.5	Cutoff and energy scales in the early Universe	35
4.6	Size of quantum corrections, counterterms and all that	36
4.6.1	Effective field theory for inflation	36
4.6.2	Connection with the low energy physics	41
4.6.3	Generalization	44
4.7	Discussion	47
5	Self-healing versus new physics	49
6	General strategy	51
6.1	From propagator to vertex functions	53

7	Construction of a resummed propagator for a toy model	56
7.1	Propagator at second order in the major coupling	56
7.2	Propagator at third order in the major coupling	59
7.2.1	Triangle matrix elements	60
7.2.2	Counterterms	64
7.3	Sum of all diagrams at third order in major coupling	66
7.3.1	Cancellation of the imaginary part at the poles	67
7.3.2	Sum of the finite imaginary parts	68
7.3.3	Approximation of the finite imaginary part	70
8	Resummed propagator for Higgs inflation potential	73
8.1	Propagator at second order in the major coupling	73
8.2	Propagator at third order in the major coupling	75
8.3	Numerical computation of the third order	76
9	Generalization to arbitrary potential	80
9.1	Asymptotic behavior of some series	82
9.2	First type of potential	83
9.3	Intermediate type of potential	86
9.4	Second type of potential	86
9.4.1	Behavior of the potential with factorial's coefficients	87
9.4.2	Potential given by an asymptotic series	88
9.5	Third type of potential	90
10	Conclusions	95
A	Fermions	100
B	Gauge bosons	102
C	Propagator at second order (Toy model)	103
D	Computation of the third order in the major coupling	106
E	Coefficients of the Higgs inflation potential	108
F	Borel and Mittag-Leffler summation	111
G	Computation of $F_3(k^2)$	112