

# Contents

Chapter 1. Introduction	1
Chapter 2. A-infinity algebra over a noncommutative base	9
2.1. Review of filtered A-infinity category and weak Maurer-Cartan elements	9
2.2. $A_\infty$ -functors and Yoneda embedding	11
2.3. $A_\infty$ -algebra over a noncommutative base and weakly unobstructedness	12
Chapter 3. Noncommutative mirror from a single Lagrangian and the centrality theorem	15
3.1. Noncommutative family of Maurer-Cartan elements	16
3.2. Noncommutative mirrors using a single immersed Lagrangian	17
3.3. Spacetime superpotential and Maurer-Cartan equation	18
3.4. Centrality	19
Chapter 4. The mirror functor from a single Lagrangian	21
Chapter 5. Elliptic curves and deformation quantizations	25
5.1. Deforming the reference Lagrangian	26
5.2. Sklyanin algebras as Weak Maurer-Cartan relations	27
5.3. Noncommutative potential	30
5.4. $(a, b, c)$ and the mirror elliptic curve	32
5.5. Relation to the quantization of an affine del Pezzo surface	33
Chapter 6. Mirror construction using several Lagrangians and quiver algebras	37
6.1. Path algebra and the semi-simple ring	37
6.2. Mirror construction	39
6.3. Centrality and the spacetime superpotential	40
6.4. The mirror functor	41
Chapter 7. Finite group symmetry and graded mirror functors	43
7.1. Kähler manifolds with finite group symmetry	44
7.2. Calabi-Yau manifolds with finite-group symmetry	50
Chapter 8. 4-punctured spheres and the pillowcase	61
8.1. Mirror of the four-punctured sphere	62
8.2. Mirror of the pillowcase	64
8.3. Open mirror theorem	66
8.4. Deformation of the reference Lagrangian $\mathbb{L}$	67
8.5. Relation to the quantization of an intersection of two quadrics in $\mathbb{C}^4$	71
Chapter 9. Extended mirror functor	75

9.1. Extended Landau-Ginzburg mirror	75
9.2. Extended mirror functor	79
Chapter 10. Mirror construction for punctured Riemann surface	83
10.1. Reference Lagrangian $\mathbb{L}$ from a polygonal decomposition	84
10.2. Floer theory for $\mathbb{L}$ and its Maurer-Cartan space for a dimer $Q$	85
10.3. Relation to the mirror dimer model $Q^\vee$	88
10.4. The case of a non-dimer $Q$	90
10.5. Perfect matching and $\mathbb{Z}$ -grading	91
10.6. Mirror functor	92
Chapter 11. Mirrors of Calabi-Yau threefolds associated with quadratic differentials	97
11.1. Non-compact Calabi-Yau threefolds associated with quadratic differentials	98
11.2. Generalized mirrors	99
11.3. Mirror functor	102
Appendix A. Theta function calculations	107
A.1. Weak Maurer-Cartan relations for $\mathbb{P}_{3,3,3}^1$	107
A.2. Weak Maurer-Cartan relations for $\mathbb{P}_{2,2,2,2}^1$	107
A.3. Embedding of $E_\tau$ into $\mathbb{P}^3$	109
Bibliography	111