

1. Record Nr.	UNISA996217604303316
Titolo	Review of Vietnamese studies / Vietnamese Studies Internet Resource Center
Pubbl/distr/stampa	[S.l.] , : VSIRC, 2001-
Descrizione fisica	Online-Ressource
Disciplina	390 300 330
Soggetti	Zeitschrift
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Periodico
Note generali	Gesehen am 25.05.05
2. Record Nr.	UNINA9910427685303321
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Titolo	Aspects of scattering amplitudes and moduli space localization // Sebastian Mizera
Pubbl/distr/stampa	Cham, Switzerland : , : Springer, , [2020] ©2020
ISBN	3-030-53010-8
Edizione	[1st ed. 2020.]
Descrizione fisica	1 online resource (XVII, 134 p. 18 illus., 14 illus. in color.)
Collana	Springer Theses
Disciplina	515.37
Soggetti	Differential forms Riemann surfaces Geometry, Differential
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia

## Nota di contenuto

Chapter1: Introduction -- Chapter2: Intersection Numbers of Twisted Differential Forms -- Chapter3: Recursion Relations from Braid Matrices -- Chapter4: Further Examples of Intersection Numbers -- Chapter5: Conclusion.

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## Sommario/riassunto

This thesis proposes a new perspective on scattering amplitudes in quantum field theories. Their standard formulation in terms of sums over Feynman diagrams is replaced by a computation of geometric invariants, called intersection numbers, on moduli spaces of Riemann surfaces. It therefore gives a physical interpretation of intersection numbers, which have been extensively studied in the mathematics literature in the context of generalized hypergeometric functions. This book explores physical consequences of this formulation, such as recursion relations, connections to geometry and string theory, as well as a phenomenon called moduli space localization. After reviewing necessary mathematical background, including topology of moduli spaces of Riemann spheres with punctures and its fundamental group, the definition and properties of intersection numbers are presented. A comprehensive list of applications and relations to other objects is given, including those to scattering amplitudes in open- and closed-string theories. The highlights of the thesis are the results regarding localization properties of intersection numbers in two opposite limits: in the low- and the high-energy expansion. In order to facilitate efficient computations of intersection numbers the author introduces recursion relations that exploit fibration properties of the moduli space. These are formulated in terms of so-called braid matrices that encode the information of how points braid around each other on the corresponding Riemann surface. Numerous application of this approach are presented for computation of scattering amplitudes in various gauge and gravity theories. This book comes with an extensive appendix that gives a pedagogical introduction to the topic of homologies with coefficients in a local system.

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