

## Moduli of Vector Bundles on Curves with Parabolic Structures

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### Introduction

Let  $H$  be the upper half plane and  $\Gamma$  a discrete subgroup of  $\text{Aut } H$ . When  $H \bmod \Gamma$  is compact, one knows that the moduli space of unitary representations of  $\Gamma$  has an algebraic interpretation (cf. [7] and [10]); for example, if moreover  $\Gamma$  acts *freely* on  $H$ , the set of isomorphism classes of unitary representations of  $\Gamma$  can be identified with the set of equivalence classes of *semi-stable* vector bundles of degree zero on the smooth projective curve  $H \bmod \Gamma$ , under a certain equivalence relation. The initial motivation for this work was to extend these considerations to the case when  $H \bmod \Gamma$  has *finite measure*.

Suppose then that  $H \bmod \Gamma$  has finite measure. Let  $X$  be the smooth projective curve containing  $H \bmod \Gamma$  as an open subset and  $S$  the finite subset of  $X$  corresponding to parabolic and elliptic fixed points under  $\Gamma$ . Then to interpret algebraically the moduli of unitary representation of  $\Gamma$ , we find that the problem to be considered is the moduli of vector bundles  $V$  on  $X$ , endowed with additional structures, namely flags at the fibres of  $V$  at  $P \in S$ . We call these *quasi parabolic structures* of  $V$  at  $S$  and, if in addition we attach some weights to these flags, we call the resulting structures *parabolic structures* on  $V$  at  $S$  (cf. Definition 1.5). The importance of attaching weights is that this allows us to define the notion of a *parabolic degree* (generalizing the usual notion of the degree of a vector bundle) and consequently the concept of *parabolic semi-stable* and *stable vector bundles* (generalizing Mumford's definition of semi-stable and stable vector bundles). With these definitions one gets a complete generalization of the results of [7, 10, 12] and in particular an algebraic interpretation of unitary representations of  $\Gamma$  via parabolic semi-stable vector bundles on  $X$  with parabolic structures at  $S$  (cf. Theorem 4.1).

The basic outline of proof in this paper is exactly the same as in [12], however, we believe, that this work is not a routine generalization. There are some new aspects and the following are perhaps worth mentioning. One is of course the idea of parabolic structures; this was inspired by the work of Weil (cf. [16], p. 56). The second is a technical one but took some time to arrive at, namely when one

# Moduli Of Vector Bundles

**Andrej N. Tjurin**



## **Moduli Of Vector Bundles:**

**Moduli of Vector Bundles** Masaki Maruyama, 1996-04-23 Contains papers presented at the 35th Taniguchi International Symposium held recently in Sanda and Kyoto Japan Details the latest developments concerning moduli spaces of vector bundles or instantons and their application Covers a broad array of topics in both differential and algebraic geometry

*Moduli Spaces and Vector Bundles* Steve Bradlow, 2009-05-21 Coverage includes foundational material as well as current research authored by top specialists within their fields

Compact Moduli Spaces and Vector Bundles Valery Alexeev, 2012 This book contains the proceedings of the conference on Compact Moduli and Vector Bundles held from October 21-24 2010 at the University of Georgia This book is a mix of survey papers and original research articles on two related subjects Compact Moduli spaces of algebraic varieties including of higher dimensional stable varieties and pairs and Vector Bundles on such compact moduli spaces including the conformal block bundles These bundles originated in the 1970s in physics the celebrated Verlinde formula computes their ranks Among the surveys are those that examine compact moduli spaces of surfaces of general type and others that concern the GIT constructions of log canonical models of moduli of stable curves The original research articles include among others papers on a formula for the Chern classes of conformal classes of conformal block bundles on the moduli spaces of stable curves on Looijenga's conjectures on algebraic and tropical Brill-Noether theory on Green's conjecture on rigid curves on moduli of curves and on Steiner surfaces

*Algebraic Stacks and Moduli of Vector Bundles* Frank Neumann, 2009

**Moduli Spaces and Vector Bundles—New Trends** Peter Gothen, Margarida Melo, Montserrat Teixidor i Bigas, 2024-07-18 This volume contains the proceedings of the VBAC 2022 Conference on Moduli Spaces and Vector Bundles New Trends held in honor of Peter Newstead's 80th birthday from July 25-29 2022 at the University of Warwick Coventry United Kingdom The papers focus on the theory of stability conditions in derived categories non reductive geometric invariant theory Brill-Noether theory and Higgs bundles and character varieties The volume includes both survey and original research articles Most articles contain substantial background and will be helpful to both novices and experts

**Grassmannians, Moduli Spaces and Vector Bundles** David Ellwood, Emma Previato, 2011 This collection of cutting edge articles on vector bundles and related topics originated from a CMI workshop held in October 2006 that brought together a community indebted to the pioneering work of P E Newstead visiting the United States for the first time since the 1960s Moduli spaces of vector bundles were then in their infancy but are now as demonstrated by this volume a powerful tool in symplectic geometry number theory mathematical physics and algebraic geometry In fact the impetus for this volume was to offer a sample of the vital convergence of techniques and fundamental progress taking place in moduli spaces at the outset of the twenty first century This volume contains contributions by J E Andersen and N L Gammelgaard Hitchin's projectively flat connection and Toeplitz operators M Aprodu and G Farkas moduli spaces D Arcara and A Bertram stability in higher dimension L Jeffrey intersection cohomology J Kamnitzer Langlands

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Schneider, 2013-11-11 These lecture notes are intended as an introduction to the methods of classification of holomorphic vector bundles over projective algebraic manifolds  $X$  To be as concrete as possible we have mostly restricted ourselves to the case  $X = \mathbb{P}^n$  According to Serre GAGA the classification of holomorphic vector bundles is equivalent to the classification of algebraic vector bundles Here we have used almost exclusively the language of analytic geometry The book is intended for students who have a basic knowledge of analytic and or algebraic geometry Some fundamental results from these fields are summarized at the beginning One of the authors gave a survey in the Seminaire Bourbaki 1978 on the current state of the classification of holomorphic vector bundles over  $\mathbb{P}^n$  This lecture then served as the basis for a course of lectures in Gottingen in the Winter Semester 78/79 The present work is an extended and up dated exposition of that course Because of the introductory nature of this book we have had to leave out some difficult topics such as the restriction theorem of Barth As compensation we have appended to each section a paragraph in which historical remarks are made further results indicated and unsolved problems presented The book is divided into two chapters Each chapter is subdivided into several sections which in turn are made up of a number of paragraphs Each section is preceded by a short description of its contents

Moduli of Vector Bundles on Non-compact Surfaces and Their Deformations Severin Barmeier, 2018 **Linear Systems on Ruled Surfaces and Moduli of Vector Bundles Over Curves** Angela Gail Vieri, 2004 Lectures on Vector Bundles J. Le Potier, 1997-01-28 This work consists of two sections on the moduli spaces of vector bundles The first part tackles the classification of vector bundles on algebraic curves The author also discusses the construction and elementary properties of the moduli spaces of stable bundles In particular Le Potier constructs Hilbert-Schottmann-Grothendieck schemes of vector bundles and treats Mumford's geometric invariant theory The second part centers on the structure of the moduli space of semistable sheaves on the projective plane The author sketches existence conditions for sheaves of given rank and Chern class and construction ideas in the general context of projective algebraic surfaces Professor Le Potier provides a treatment of vector bundles that will be welcomed by experienced algebraic geometers and novices alike On Moduli of Vector Bundles on  $p$ -adic Curves and Attached Representations Dimitri Wegner, 2014 **Group Actions on Moduli of Vector Bundles** Satyajit Karnik, 2000 Proceedings of the International Congress of Mathematicians S.D. Chatterji, 2012-12-06 Since the

first ICM was held in Zürich in 1897 it has become the pinnacle of mathematical gatherings It aims at giving an overview of the current state of different branches of mathematics and its applications as well as an insight into the treatment of special problems of exceptional importance The proceedings of the ICMs have provided a rich chronology of mathematical development in all its branches and a unique documentation of contemporary research They form an indispensable part of every mathematical library The Proceedings of the International Congress of Mathematicians 1994 held in Zürich from August 3rd to 11th 1994 are published in two volumes Volume I contains an account of the organization of the Congress the list of ordinary members the reports on the work of the Fields Medalists and the Nevanlinna Prize Winner the plenary one hour addresses and the invited addresses presented at Section Meetings 1-6 Volume II contains the invited address for Section Meetings 7-19 A complete author index is included in both volumes the content of these impressive two volumes sheds a certain light on the present state of mathematical sciences and anybody doing research in mathematics should look carefully at these Proceedings For young people beginning research this is even more important so these are a must for any serious mathematics library The graphical presentation is as always with Birkhäuser excellent *Revue Roumaine de Mathématiques pures et Appliquées*     The Moduli Spaces of Vector Bundles on Threefolds, Surfaces and Curves I Andrej N. Tjurin, 1990

**On Motives and moduli spaces of stable vector bundles over a curve** Sebastian del Baño Rollin, Pascual Gainza, Pere, 1998     *Affine Flag Manifolds and Principal Bundles* Alexander Schmitt, 2011-01-28 Affine flag manifolds are infinite dimensional versions of familiar objects such as Grassmann varieties The book features lecture notes survey articles and research notes based on workshops held in Berlin Essen and Madrid explaining the significance of these and related objects such as double affine Hecke algebras and affine Springer fibers in representation theory e.g. the theory of symmetric polynomials arithmetic geometry e.g. the fundamental lemma in the Langlands program and algebraic geometry e.g. affine flag manifolds as parameter spaces for principal bundles Novel aspects of the theory of principal bundles on algebraic varieties are also studied in the book     **Collection of Papers on Geometry, Analysis and Mathematical Physics**

Daqian Li, 1997 This volume is published in honor of Professor Gu Chaohao a renowned mathematician and member of the Chinese Academy of Sciences on the occasion of his 70th birthday and his 50th year of educational work The subjects covered by this collection are closely related to differential geometry partial differential equations and mathematical physics the major areas in which Professor Gu has received notable achievements Many distinguished mathematicians all over the world contributed their papers to this collection This collection also consists of Gu Chaohao and I written by C N Yang The academic career and accomplishment of Professor Gu Chaohao by T T Li and List of publications of Professor Gu Chaohao

**Vector Bundles** Andrej N. Tjurin, 2008 This is the first volume of a three volume collection of Andrey Nikolaevich Tyurin's Selected Works It includes his most interesting articles in the field of classical algebraic geometry written during his whole career from the 1960s Most of these papers treat different problems of the theory of vector bundles on curves and higher

dimensional algebraic varieties a theory which is central to algebraic geometry and most of its applications     *Algebraic Geometry Santa Cruz 1995* János Kollár, David R. Morrison, 1997     **Algebraic Geometry** Dr. B. Phalaksha Murthy, Dr. P. Somashekhara, Prof. P. Somashekar, 2024-09-20 Algebraic Geometry is a profound exploration of the intersection between algebra and geometry delving into the study of geometric structures defined by polynomial equations This book covers foundational topics such as varieties schemes and morphisms bridging abstract algebraic theories with tangible geometric interpretations Through rigorous proofs and illustrative examples it guides readers from basic concepts to advanced topics including cohomology intersection theory and moduli spaces Ideal for mathematicians and students Algebraic Geometry serves both as a comprehensive introduction and as a reference for deeper mathematical inquiries in geometry

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