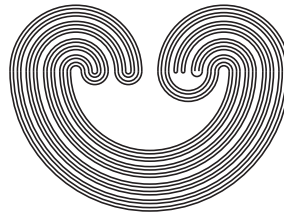


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## RATIONALITY OF THE $SL(2, \mathbb{C})$ -REIDEMEISTER TORSION IN DIMENSION 3

by

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## RATIONALITY OF THE $SL(2, \mathbb{C})$ -REIDEMEISTER TORSION IN DIMENSION 3

JEROME DUBOIS AND STAVROS GAROUFALIDIS

**ABSTRACT.** If  $M$  is a finite volume complete hyperbolic 3-manifold with one cusp and no 2-torsion, the geometric component  $X_M$  of its  $SL(2, \mathbb{C})$ -character variety is an affine complex curve, which is smooth at the discrete faithful representation  $\rho_0$ . Porti defined a non-abelian Reidemeister torsion in a neighborhood of  $\rho_0$  in  $X_M$  and observed that it is an analytic map, which is the germ of a unique rational function on  $X_M$ . In the present paper we prove that (a) the torsion of a representation lies in at most quadratic extension of the invariant trace field of the representation, and (b) the existence of a polynomial relation of the torsion of a representation and the trace of the meridian or the longitude. We postulate that the coefficients of the  $1/N^k$ -asymptotics of the Parametrized Volume Conjecture for  $M$  are elements of the field of rational functions on  $X_M$ .

### 1. INTRODUCTION

**1.1. The volume of an  $SL(2, \mathbb{C})$ -representation and the  $A$ -polynomial.** A well-known numerical invariant of a 3-dimensional finite volume hyperbolic manifold  $M$  with a cusp is its *volume*, a positive real number. A complete invariant of the hyperbolic structure of  $M$  is a discrete faithful representation of  $\pi_1(M)$  into  $PSL(2, \mathbb{C})$  (well-defined up to conjugation) which is also a topological invariant, as follows from Mostow rigidity Theorem. Every  $PSL(2, \mathbb{C})$ -representation  $\rho$  of  $\pi_1(M)$  has a real-valued volume  $\text{Vol}(\rho)$ ; see [14, Ch.2] and also [17, 16]. When a representation

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