

## Tau Functions for the Dirac Operator on the Poincaré Disk

John Palmer<sup>1</sup>, Morris Beatty<sup>2</sup>, Craig A. Tracy<sup>2</sup>

 <sup>1</sup> Department of Mathematics, University of Arizona, Tucson, AZ 85721, USA
<sup>2</sup> Department of Mathematics and Institute of Theoretical Dynamics, University of California, Davis, CA 95616, USA

Received: 18 September 1993/in revised form: 7 January 1994

**Abstract:** In this paper we define tau functions for holonomic fields associated with the Dirac operator on the Poincaré disk. The deformation analysis of the tau functions is worked out and in the case of the two point function, the tau function is expressed in terms of a Painlevé function of type VI.

## Table of Contents

In	troduction	98
1	The Dirac operator on the Hyperbolic disk	101
	A covering of the frame bundle.	101
	The Dirac operator	104
	Covariance of the Dirac operator	106
2	Local Expansions	109
	Eigenfunctions for infinitesimal rotations	109
	Differentiating local expansions with respect to the branch points	115
	Estimates at infinity	118
3	$L^2$ existence results	121
	A model for the simply connected covering $D_R(a)$	121
	Multivalued solutions with specified branching	123
	Existence for a canonical $L^2$ basis	127
	The response functions	129
4	The Green function $G^{a,\lambda}$ for the Dirac operator	131
	Green functions in the absence of branch points	131
	The Green function for the Helmholtz operator with branch points	134
	The Green function for the Dirac operator with branch points	140
	The derivative of the Green function $G^{a,\lambda}$	142
5	Deformation Equations	145
	A holonomic system	145
	The holonomic extension	149