

# Two-Reduction of the Super-KP Hierarchy

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**Abstract:** Recursion relations are established for the residues of fractional powers of a two-reduced super-KP operator making use of the Baker-Akhiezer function. These show the integrability of the two-reduced even (or bosonic) flows of the super-KP hierarchy. Similar recursion relations are also proven for the residues of operators associated with the odd (or fermionic) flows of the Mulase-Rabin super-KP hierarchy. Due to the presence of a spectral parameter and its fermionic partner in the Baker-Akhiezer function, these recursion relations should be relevant to any attempt to prove or disprove a recent proposal that the integrable hierarchy underlying two-dimensional quantum supergravity is the Mulase-Rabin super-KP hierarchy.

## 1. Introduction

A surprising link has been established between the quantum theory of two-dimensional gravity and integrable hierarchies of nonlinear equations of the KdV type [1]. It is therefore of considerable interest to discover whether an integrable system underlies two-dimensional quantum supergravity and its topological counterpart. Recent study of a plausible superloop equation [7] has suggested that the Mulase-Rabin super-KP (SKP) hierarchy [11, 6] (or a reduction thereof) is a contender for this role. Further study of this system is therefore warranted.

In this paper, a two-reduced SKP operator is studied. Making use of the Baker-Akhiezer function of the Mulase-Rabin SKP hierarchy, identities and recursion relations satisfied by fractional powers of the reduced operator are established, which show that the two-reduced even (or bosonic) flows of the SKP hierarchy are consistent and Hamiltonian. This Hamiltonian structure has been found previously by Oevel and Popowicz [3] using the Lax formulation of the two-reduced even flows. However, the approach taken in this paper is perhaps more relevant to any attempt to prove or disprove the speculation that the integrable system underlying two-dimensional quantum supergravity is a reduction of the Mulase-Rabin SKP hierarchy [7, 8]. This is because of the appearance of a spectral parameter and its fermionic partner via the Baker function, as discussed further in the conclusion.