Algebraic methods in classical & quantum integrable systems

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The proposed research project will explore interrelations between classical and quantum integrable (exactly solvable) systems. A key theme is that certain boundary conditions that preserve integrability may completely change the behaviour of the bulk system. Interrelations between quantum lattice models and continuum classical field theories will be investigated at the algebraic level as well as at the level of physical computations via the Bethe ansatz formulation. Another key direction of the proposed research plan is to extend the study of integrable defects. We will investigate various still unknown aspects of integrable defects at both classical and quantum level. At the classical level we will first extend existing work to the description of multiple point-like defects in various classical models such as Landau-Lifshitz, non-linear Schrödinger models and Affine Toda Field Theories. These multiple defects will be described by combinations of bulk and defect matrices (Darboux-Bäcklund transformations) with independent defect parameters and sewing conditions at each defect point. The conditions for Liouville integrability of such models will be demonstrated. Similar ideas will be explored in the framework of quantum integrable systems such as spin chains and vertex models.

This study will be mainly based on the underlying Poison and quantum algebras governing these models. This work is highly topical because of the recent surge of interest in integrable systems, in particular those involving boundaries and defects. This interest is due to the increasing connections with AdS/CFT-string theory and because of the unprecedented physical realisation of such systems in cold-atom experiments.

The overall aims of the project are:

- To investigate aspects of boundary effects specifically related to the lattice discretization and to quantization by considering the continuum, classical continuum limits.
- To construct and analyse classical and quantum integrable extended-defect models - with potential applications to condensed matter and string theory.
- To construct Bäcklund transformations for discrete & continuous integrable models and consider their algebraic justification
- To use of Hamiltonian/algebraic methods in integrable PDEs.

COMMISSION DE RECHERCHE RESTREINTE

Avis de la commission : ☐ **Favorable** ☐ **Défavorable** **Durée d'invitation proposée :** .....

Prise en charge financière proposée :

Séjour de 1 à 3 semaines
Niveau 1 : 150 € / jour ☐
Niveau 2 : 120 € / jour ☐
Niveau 3 : 90 € / jour ☐

Séjour supérieur à 3 semaines
(Indice de rémunération)
PR : ☐ 821 ☐ 1115
MCF : ☐ 673 ☐ 821

Date :

Signature du Vice-Président

CONSEIL D'ADMINISTRATION RESTREINT

Décision du conseil : ☐ **Favorable** ☐ **Défavorable** **Durée d'invitation attribuée :** .....

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