

Short Visit Scientific Report  
**Quantum spectral curves for spin models**

The purpose of the visit to the department of mathematics of the Angers University was to study with V. Rubtsov and his group A. Chervov algebraic properties of "quantum spectral curves" (QSP) or "quantum characteristic polynomial" of Lax operators  $L(z)$  associated with quantum spin integrable systems.

The relevance of such a notion – that in some form was already present in the pioneering works of Sklyanin et. al. about  $R$ -matrices – was recently emphasized in a series of papers by D. Talalaev and A. Chervov.

The basic achievement of the visit is that, together with Dr. Chervov, I was able to thoroughly discuss and substantially finish a paper, entitled "Manin's matrices and the Talalaev formula" - a first version of that having been already posted on the q-alg archive.

The content of this paper can be summarized as follows.

We start from the observation that elements of (Quantum) Lax matrices (obeying linear or quadratic  $R$ -matrix relations) satisfy special commutation relations, that are a special case of those considered in a somewhat old paper by Yu. I. Manin (whence the name of Manin's matrices). We show that (elementary and more advanced) properties of ordinary matrices – that is, matrices with numerical elements - hold in this case almost *verbatim*, and derive applications for the matrices entering integrable quantum models. For example, we characterize new sets of quantum commuting quantities in Gaudin-type models, discuss applications to the Knizhnik-Zamolodchikov equations, and finally touch - in some special cases - the problem of "quantum separation of variables".

Furthermore, we discussed the aims and content of a further paper, to be written in collaboration also of V. Rubtsov, containing further material, as well as the proof of some properties of Manin's matrices that, at the moment of writing are still at a conjectural level.

Finally, I was able to discuss with V. Rubtsov, both in a seminar and privately, about our mutual interests about classes of integrable PDEs such as the Camassa-Holm equations and its generalizations.

We plan to pursue this promising research line further in the next months.