Staff : D. Andriot, D. Chicherin, L. Frappat, L. Gallot, E. Ragoucy, F. Thuillier et P. Tourkine.

Active retired staff : P. Sorba and E. Sokatchev

ANR: SPARTA

The mathematical physics team has gained international recognition in three major areas: gauge theories (particularly supersymmetric Yang-Mills gauge theories), string theories, and integrable systems. Over the past years, the team has achieved excellent results in each of these fields. It should be noted that these three areas are closely related. On one hand, gauge theories and string theories are dual, meaning that it is possible to switch between them by exchanging regimes of weak or strong coupling. On the other hand, some of these theories possess integrable parts and are sometimes assumed to be completely integrable.

Regarding supersymmetric gauge theories, the team is recognized as a leader in the calculation of scattering amplitudes, in relation to particle physics. They work on perturbative and non-perturbative aspects (including via the bootstrap) of scattering amplitudes and S-matrices in field theory and quantum gravity,.

The group has also expanded into the field of string theory, which offers a perspective to include gravity in particle physics. The researchers seek to establish connections between string theory and phenomenology, especially with cosmology, in relation to the Swampland program. Their goal is to obtain de Sitter solutions, as well as other cosmological models, from string theory in order to explain dark energy responsible for the accelerated expansion of our universe.

In the field of integrable systems, the team is leader in the calculation of correlation functions of spin chains, within the framework of the algebraic Bethe ansatz. They have a strong expertise in the theory of Lie algebras and integrable field theory. They also develop the study of integrability in statistical physics of non-equilibrium systems, a generalization of usual thermodynamics.

Finally, the team also conducts research in the fields of topological field theories, addressing more formal aspects of field theory with developments in both mathematics and physics, as well as classical gravitational field theories, including the construction of stationary solutions describing black holes in general relativity.