Emergent Research:
The PIMS Postdoctoral Fellow Seminar

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Pacific Institute *for the* Mathematical Sciences

Exact results in quantum field theory from differential systems.

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ABSTRACT:
Despite being the most efficient set of computational techniques available to the theoretical physicist, quantum field theory (QFT) does not describe all the observed features of the quantum interactions of our universe. At the same time, its mathematical formulation beyond the approximation scheme of perturbation theory is yet to be understood as a whole. I am following a path that tries to solve these two parallel problems at once and I will tell the story of how that way is paved by the study of equivariant differential systems and homology with local coefficients. More precisely, I will introduce these main characters in two space-time dimensions and describe how their symplectic geometry contains the data of correlation functions in conformally invariant QFT. If time allows, I will discuss how the Lax formulation of integrable systems in terms of Higgs bundles gives us hints as per how to extend the method to cases with four space-time dimensions.

SPEAKER BIO:
Raphaël Belliard obtained his PhD at the CEA of Saclay, the French historical nuclear physics research center. Under the supervision of Dr. Bertrand Eynard, he studied geometric features of solvable symmetry constraints in two-dimensional quantum field theory using methods directly inspired from statistical models of heavy atom spectroscopy. They involved mathematics ranging from combinatorics to intersection theory and representations of infinite dimensional algebras. In particular extensions of the Virasoro algebra, relevant for conformal field theories that he studied at DESY Hamburg under the supervision of Dr. Joerg Teschner. He is currently a PIMS PDF at the University of Alberta, Edmonton, where he works with Dr. Vincent Bouchard and others on algebraic and geometric structures that could allow to generalise fruitful aspects of his approach to four-dimensional models.

For more information and registration:
https://www.pims.math.ca/seminars/PIMSPDF

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PIMS ongoing lecture series featuring our Postdoctoral Fellows every three weeks. You will have the opportunity to connect with emerging research in the mathematical sciences from a PIMS Postdoctoral Fellow. PIMS PDFs are amongst the top young researchers in Canada, and this is an excellent opportunity to learn about them, and their work.