ＪＷＵシーズ

研究者名※	ジェラード　アラン GERRARD, ALLAN	学位※	PhD in Mathematics（ヨーク大学） Master of Mathematics　（ケンブリッジ大学）
所属※	理学部 数物情報科学科	職名※	助教
連絡先	gerrarda@fc.jwu.ac.jp		
ＵＲＬ	http://www.allangerrard.com/		
researchmap※	https://researchmap.jp/allanjgerrard		
研究分野※	数物系科学/物理学/数理物理・物性基礎		
研究キーワード※	物性基礎論、数理物理		
共同研究・競争的資金等の研究課題			
社会貢献・産学官連携活動等			
受賞歴			

研究領域		（SDGs）
研究テーマ※	Exact energy eigenvectors of quantum spin chains	
概要※ （概ね1000字以内） （写真・グラフ等自由）	【研究の背景・目的・内容】 My research concerns exact analysis of one-dimensional quantum mechanical systems called spin chains. The most basic systems in physics are those where a single particle moves on a one-dimensional line: even introducing quantum mechanical effects, it is possible to understand the dynamics of single particle exactly in terms of its momentum. The bulk of my research concerns understanding the interactions of spin waves on these systems. The wavefunction of a single particle in a finite quantum mechanical system decomposes into standing waves of constant momentum: this is simply the discrete Fourier transform. Once a second particle is added into the system, it is usually not possible to fully understand the wavefunction. Spin chains, however, have a simple enough interaction that the whole system can be solved exactly, for any number of interacting particles. This method is called the Bethe ansatz. In our most recent research, we study the energy eigenfunction of the spin chain, as a symmetric function in many variables. While the structure of this function is very complex, it possesses a vast number of symmetries, allowing us to determine its exact structure. 【応用例、研究の展望】 I hope to extend the results of this study to spin chains with nontrivial Lie symmetry and reflective boundary conditions. 【研究方法の特色】 The research relies on a wide spectrum of mathematical ideas, including special functions (elliptic functions), complex analysis and abstract algebra. The main arguments also make use of diagrammatic techniques that are inspired by knot theory.	
本研究関連特許・論文等	Gerrard, A. J.; Motegi, K.; Sakai, K. Higher Rank Elliptic Partition Functions and Multisymmetric Elliptic Functions. *Nuclear Physics B* 2025, 116805.	
共同研究・外部機関との連携への期待	・ ・	