2021 Henri Poincare Prize in Mathematical Physics

Laudatio for Professor Rodney J. Baxter

It is an honour and tremendous pleasure for me to say a few words about Rodney Baxter's works on this occasion for his richly deserved Henri Poincare Prize in mathematical physics.

Rodney Baxter's name is firmly associated with the most elegant mathematical discoveries for at least two generations of theoretical physicists and mathematicians.

Rodney graduated from Trinity College Cambridge in 1961 and received his PhD from the Australian National University (ANU) in 1964. Then after positions at the ANU and MIT he got a tenured position at ANU.

Interestingly, Rodney in his recent autobiography calls himself an "Accidental Academic". Let me read the quote: "For the first 24 years of my life I had no intention of becoming an academic. Rather I expected to earn my living as an employee of some large company, such as the Iraq Petroleum Company that I joined in 1964 as a reservoir engineer. However, things panned out differently and I'm very happy that they did. I've made a career as a mathematical physicist, working on simple models of statistical mechanical systems, asking questions akin to "why does water boil", or "why does it freeze" … . I've been able to make some contributions to the subject."

We are all very happy that Rodney did become an academic!

I first met Rodney (in person) in 1989, more than 30 years ago, during the "Special year in Mathematical Physics" program organised by Neil Trudinger's "Centre for Mathematical Analysis" at the Australian National University. This was a start of my collaboration with Rodney in the area of lattice models, which has been continuing for many years.

Of course, previously, during the 80's, I and many of my colleagues in Russia had studied Rodney Baxter's works. A typical state after such studies is a feeling of absolute and complete admiration of the beauty and sophistication of his mathematical results.

The effect is so strong that it is not unusual that at international conferences completely unknown to me people come and ask "You are working at the ANU, have you seen Professor Baxter?", clearly indicating that that would be a notable event in their life.

Baxter's work has involved solving highly non-trivial mathematical problems in the most brilliant way.

In 1971 Baxter solved the eight-vertex model on the two-dimensional lattice by inventing methods of such power and generality that the course of research in statistical mechanics was permanently altered.

In 2000 we had an international conference in Canberra, which was entitled "The Baxter Revolution in Mathematical Physics" to emphasize the broad impact of Baxter's pioneering work in many branches of physics and mathematics.

Since then the scope of new application of Baxter's work is only rapidly increasing. To date it has completely revolutionized many areas of modern mathematics, including algebra, topology, geometry and mathematical analysis. In physics, there are spectacular applications in statistical mechanics and

condensed matter physics (such as quantum gases), in quantum field theory, and most recently in string theory and high energy physics.

This revolution originates in Baxter's brilliant inventions of what are now called the Yang-Baxter equation, the corner transfer matrix, the commuting transfer matrices and functional relations for their eigenvalues.
In his pioneering paper on the hard-hexagon model Baxter has discovered the connections with the Rogers-Ramanujan identities, which besides the exact results for expectation values has led to a dual boson-fermion description for lattice models.

Baxter's work has also led to

(i) the invention of quantum groups by Drinfeld and Jimbo, who have been honoured for their work by the Fields Medal for Drinfeld in 1990 and the Wigner Medal for Jimbo in 2010;

(ii) the discovery of a knot invariant by Jones, who was honoured by the Fields Medal in 1990;

(iii) the development by Sklyanin, Takhtajan and Faddeev of the powerful Quantum Inverse Scattering Methods for solving models of statistical mechanics and quantum field theory.

(iv) the connection of Gauge/String theory and 2D integrable system (Maldacena, Minahan-Zarembo, Costello-Witten-Yamazaki and many others).

Baxter's work has inspired many other developments by researchers around the world, including Andrews, Au-Yang, McCoy, Perk and Tracy in the USA, Belavin, Fateev, Zamolodchikov, Tsvelik, Wiegmann, Korepin, Kirillov, Smirnov and Reshetikhin in Russia, Date, Miwa and Jimbo in Japan, Maillet, Pasquier and Saleur in France, Pearce and Forrester in Australia, Mussardo in Italy among others of that generation.

Isaac Newton said "If I have seen further, it is by standing on the shoulders of giants.". He was referring to Copernicus, Galileo and Kepler. There is no doubt that Prof. Baxter is a giant who has brought the torch of mathematical physics into the 21-st century. Rephrasing Newton, I would say, "We are able to see further, because of the outstanding work of Professor Baxter".

Please join me to congratulate Professor Baxter on the award of the Henri Poincare Prize in Mathematical Physics.

Vladimir Bazhanov,
Australian National University.

ICMP 2021, Opening Ceremony,
Geneva, August 2, 2021.