Ernie Kalnins

Ernie Kalnins has been an active member of the mathematics community in New Zealand since arriving at the University of Waikato in 1975. Since this time he has made significant and prolific research contributions, especially in his work on symmetries of partial differential equations, separable coordinates and superintegrable systems. In recognition of this work, he was awarded the 2007 NZMS Research Award. Earlier recognition of his work was in 1992 when he was elected a Fellow of the Royal Society of New Zealand. He has previously been awarded two Marsden grants.

Born in Austria in 1947, Ernie came to New Zealand as part of the displaced persons group in 1949. He eventually became a New Zealand citizen and ended up in Christchurch where he studied at the University of Canterbury. He graduated from there with a BSc(Hons) degree in 1967. From Christchurch, he went to the University of Western Ontario where he completed his MSc in Applied Mathematics in 1968. He stayed there for his PhD. He completed his doctorate in 1972 with a thesis titled “Subgroup reductions of the Lorentz Group”.

After completing his doctorate, he worked for three years as a post-doctoral fellow at the University of Montreal. He then started his academic career at the University of Waikato where he began as a lecturer in 1975. He quickly rose through the ranks becoming Senior Lecturer in 1979, Associate Professor in 1985, and was promoted to a Personal Chair in Mathematics in 1994.

Ernie and Anne have two children; a son and a daughter. His hobbies include photography (with film cameras) and swimming.

For over thirty years Ernie has been an active researcher in symmetries of partial differential equations, separable coordinates and superintegrable systems.

The main thrust of the work on separable coordinates is the study and theoretical understanding of the notion of separable equations as a method for solving classical partial differential equations. What has been the cornerstone of this work is the understanding of this method from two points of view:

(1) When, given suitable constants of the motion or symmetries, can separation occur?

(2) What are all the really different separable coordinate systems on a given manifold?

This work has been the result of a longstanding collaboration with Willard Miller Jr of the University of Minnesota together with Jonathan Kress of the University of NSW, George Pogosyan of the Joint Institute for Nuclear Research in Dubna, Russia, and Pavel Winternitz of the University of Montreal.

More recently, the notion of superintegrability has been studied in detail with a view to constructing a theory of this topic. This idea generalises the properties of the equations of planetary motion and the Coulomb atom in quantum mechanics, each of which admit extra symmetries, which do not form a group. The resulting relevant idea is that of a quadratic algebra. This idea together with its representation theory forms the basis of current research.

While at Waikato he has supervised a number of graduate and postgraduate students. Titles of PhD theses from his students include "Variable separation for heat and Schrödinger equations", "Killing spinors, Teukolsky equations and the intrinsic characterisation of spin wave equations", "Bodies of finite extent in classical and general relativity" and "Geodesic geometry of black holes". The last three theses reflect an interest in the geodesic geometry of physically interesting space times. In particular, the geodesic geometry of black holes as well as perturbations of these space times.

Ernie has over 130 publications listed on MathSciNet. This includes his research monograph "Separation of variables for Riemannian spaces of constant curvature". He has given many talks on his research at international conferences and colloquia as well as seminars at universities he has visited. At the national level, Ernie has served on the Council of the NZMS from 1984 to 1987 and from 1993 to 1996.

The contribution of Ernie to the mathematics community has been significant and no doubt this will continue in the future.

Stephen Joe

$$\begin{aligned}
[L_i, R] &= 4\{L_i, L_k\} - 4\{L_i, L_j\} - (8 + 16a_j)L_j + (8 + 16a_k)L_k + 8(a_j - a_k), \\
R^2 &= \frac{8}{6}\{L_1, L_2, L_3\} + -(16a_1 + 12)L_1^2 - (16a_2 + 12)L_2^2 - (16a_3 + 12)L_3^2 \\
&\quad + \frac{52}{3}(\{L_1, L_2\} + \{L_2, L_3\} + \{L_3, L_1\}) + \frac{1}{3}(16 + 176a_1)L_1 \\
&\quad + \frac{1}{3}(16 + 176a_2)L_2 + \frac{1}{3}(16 + 176a_3)L_3 + \frac{32}{3}(a_1 + a_2 + a_3) \\
&\quad + 48(a_1a_2 + a_2a_3 + a_3a_1) + 64a_1a_2a_3.
\end{aligned}$$