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13. ABSTRACT (Maximum 200 words)

A study of nonlinear differential and integral equations which describe time-dependent phenomena in fluids and solids has been conducted by a team of investigators at the University of Georgia. The methods of study employed include computer simulations, recurrence relations, linearization. Among significant findings are a demonstration of slow decay in a Hermitian many-body system for the first time. The origin & mechanisms of slow decay have been elucidated. The study has resulted in nearly 30 articles, most of which are in refereed journals of international standing.

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7. STATEMENT OF THE PROBLEM

A study of nonlinear partial differential and integral–differential equations which describe time–dependent phenomena in fluids and solids was undertaken by an interdisciplinary team of investigators at the University of Georgia. Emphasis was placed on approximations of water wave equations and related nonlinear optics, dvnamical lattice equations, and nonlinear Langevin equation. The methods of study employed were principally computer simulations, recurrence relations, linearization, representation theory of infinite dimensional Lie algebras and group, and inverse scattering transformations.

8. SUMMARY OF THE MOST IMPORTANT RESULTS

The efforts of our project team have resulted in nearly 30 publications, most of which have appeared in refereed journals of international standing. Because of the diversity in our output, it is difficult to judge as to which articles are more important than the others. Some articles represent certain stages of development, which later when completed may prove to be even more significant than as appeared earlier. Bearing this point in mind, we shall select a work of substantial nature which has been completed during the project period as our most important. By this criterion, the most important results of our project are represented by our publications 26 and 27.

The research findings given in these two publications concern slow decay in many–particle systems. Is there a memory in thermodynamic systems? Whether slow decay exists in an Hermitian system has been an open problem ever since numerical studies showed evidence some two decades ago. In these two articles, we have finally demonstrated rigorously that slow decay can exist under certain subtle conditions for the first time. Furthermore, the origin and mechanisms of slow decay have been elucidated. The underlying physical process in spin systems (i. e., models of magnetism) responsible for slow decay turns out to be spin precession. It suggests that mechanisms of slow decay in fluids are likely to be vorticity and vortex motion. The results stated here were obtained by solving the Heisenberg equation of motion (i. e., nonlinear Langevin equation) exactly and then by carrying out the required ensemble averages for an asymptotic time domain. Also interesting was the determination of the time domain which may be regarded as asymptotic.

9. LIST OF PARTICIPATING SCIENTIFIC PERSONNEL

A. Co–Principal Investigators

M. H. Lee, R. L. Anderson, R. A. Kunze

B. Other Investigators

D. P. Landau, M. Adams, R. Varley, T. R. Taha, J. Dorfmeister

C. Students Receiving Advanced Degrees

S. Sen, Ph.D in 1989 (under the direction of Professor M. H. Lee)
Title of Dissertation: Transverse Spin Dynamics of Ising Models in one, two and three dimensions.

10. LIST OF PUBLICATIONS

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