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Sven Gösta Nilsson in memoriam

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SVEN GÖSTA NILSSON IN MEMORIAM

The Nobel Symposium on Nuclei at Very High Spin has been dedicated to the memory of Sven Gösta Nilsson. I would therefore like to open this Symposium by saying a few words about him.

Sven Gösta gave us a rich scientific legacy which will always be with us. In spite of his premature death he left us a large number (about 75) of original papers, conference reports and monographs. Most of these researches are known to the people of this Symposium. I will however mention a few of the high lights. Certainly his thesis published in the Danish Journal, Mat. Fys. Med. Dan. Vid. Selsk. 29, No. 16 (1955) is one of the truly great papers in nuclear structure physics. The results now known as the Nilsson model are used in a large fraction of all papers in low energy nuclear physics.

His legacy includes such milestones as (1) the paper on "The Intrinsic States in Odd-A Nuclei having Ellipsoidal Equilibrium Shape" published with Ben Mottelson in 1959; (2) the paper on "The Effect of Pair Correlation on the Moment of Inertia and the Gyromagnetic Ratio of Deformed Nuclei" published with O. Prior in 1961; (3) "Collective Nuclear Motion and the Unified Model" published with Ove Nathan in 1965; (4) papers on nuclear structure and stability and in particular; (5) the stability of the super heavy elements; and (6) the shape of the fission barrier. In the last 8 years of his life Sven Gösta became increasingly interested in shell structure in nuclei, summarized in his paper of that title published in Physics Reports in 1978. This interest led to a large number of other papers on both spherical and deformed nuclei. Sven Gösta realized at a very early stage that deformation was not the only "Strutinsky variable". He investigated nuclear skin thickness and spin. This led directly to his paper on "Nuclear Shell Structure at High Angular Momentum" published in Nuclear Physics in 1976, and to a number of other papers on nuclei at very high spin, the subject of this Nobel Symposium. It is important to realize that Sven Gösta and Hans Ryde initiated the idea for this Symposium several years ago, and Sven Gösta worked untiringly at it prior to his death. He obviously was vitally interested in its success.

Sven Gösta had a special rapport with people. He put them at

their ease. They felt an almost immediate friendship. Both experimentalists and theorists were always eager to talk with him — perhaps experimentalists even more than theorists. To experience Sven Gösta Nilsson's infectious enthusiasm, his unselfishness, and the cross fire of ideas from both him and his group, often led to new directions in research. He was always willing to talk at the level of the person with whom he was associating, and his unassuming manner made it especially easy to communicate.

Because of this ability to communicate and because of his science Sven Gösta cooperated with individual scientists and groups of scientists all over the world. Without doubt his cooperation with the Niels Bohr Institute was especially significant. It represented a kind of nourishment for him and his group. On a number of occasions he spoke to me about the Lund Institute's extreme good fortune that the Niels Bohr Institute was near and the association so cordial. I should also mention the long and fruitful collaboration with Berkeley, with Warsaw, Orsay, Florida State and a host of others.

Probably also because of his personal qualities and because of the soundness of his science, the group of students which he drew around him was of extremely high quality. This has been particularly evident in recent years when the effort in low energy nuclear structure physics has in general been decreasing somewhat. Both the size and the quality of Sven Gösta Nilsson's group has increased. This is abundantly clear from the contributions to this conference.

Of course, it's almost impossible to capture the true nature of Sven Gösta, his boyish grin and his enthusiasm for science. I believe the concert in the Domkyrka in Lund yesterday afternoon spoke about him more eloquently than any words I could utter. Certainly one of the most fitting ways we can honor him is to hold this Nobel Symposium in his name. He would have enjoyed it immensely and been in the thick of the discussions. So let's get on with it.

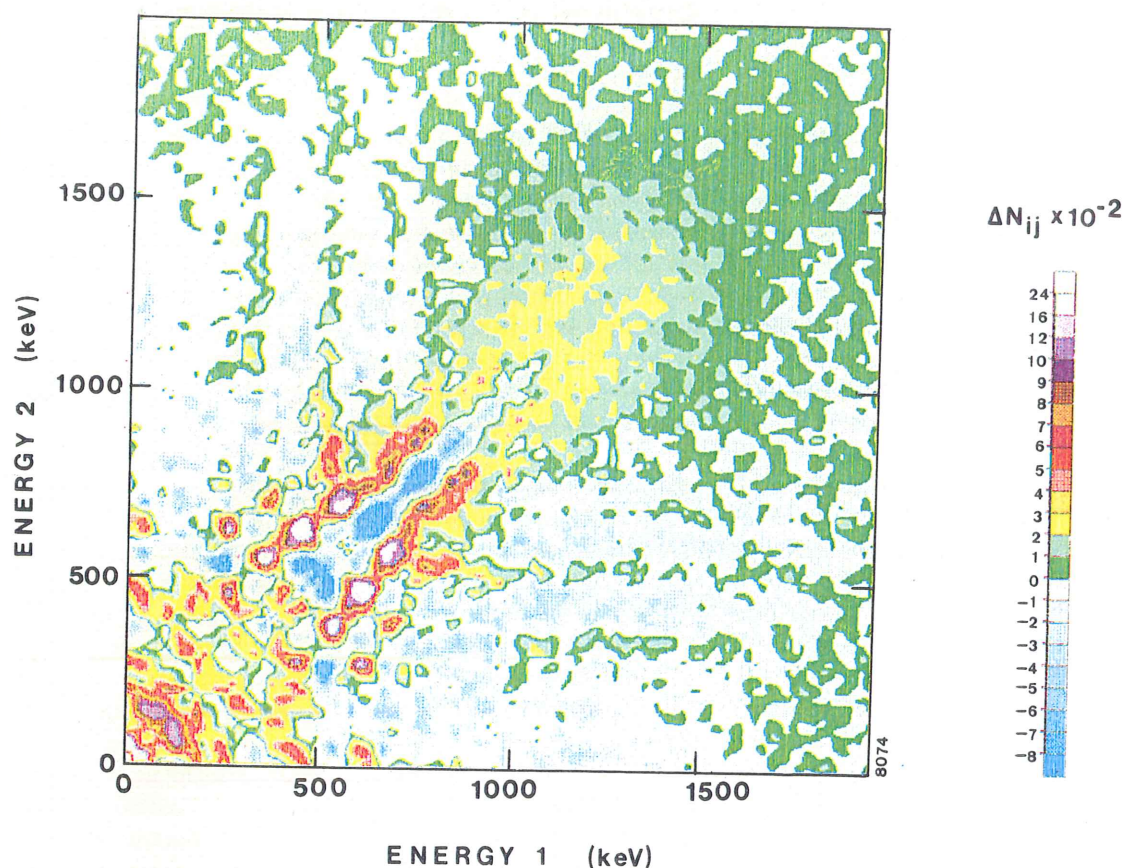
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A warmly personal biographical article about Sven Gösta Nilsson has been written by Torsten Gustafsson for the Proceedings of the Royal Physiographic Society of Lund. It has been translated into English at the Department of Mathematical Physics of the University of Lund. The scientific contribution made by Sven Gösta Nilsson will be described by Aage Bohr and Ben Mottelson in a forth-coming memorial issue of "Nuclear Physics".



Physica Scripta



Nuclei at Very High Spin - Sven Gösta Nilsson in Memoriam.

Proceedings of Nobel-Symposium 50
Örenäs, Sweden, June 23-27, 1980.
Editors: G. Leander and H. Ryde.

Introduction

It is intuitively clear that near-grazing collisions between two heavy ions are likely to result in final states describing rapid rotation. A statistical theory for the population of very high-spin states was worked out already in the 1960's. The continued development and application of this theory is an important first step in the interpretation of the experimental results. Specific resonant states may be seen in light nuclei, but for heavier nuclei the statistical approach is used to understand the cooling of the system until it reaches the vicinity of the yrast states, that is the states having the lowest possible energy for each spin value. There, individual structural effects come into play and fine details are now being discovered, through the use of more selective filtering techniques, in spectra that were called "statistical" a few years ago. A variety of means are being tried to identify the contributions from the very highest spins, to quantify the individual properties such as energies, multipolarities and life-times, but also the relative properties that express collective correlations.

During the early 1970's it became clear that there were other basic aspects to nuclear rotation than those considered in the statistical models. In a cosmic perspective it was pointed out that systems with spherical equilibrium shapes are distorted by rotations. The parameters of the nuclear system are sufficiently well known to predict a number of different shape regimes at spins below the critical spin for the fissioning of the nucleus. The connections between macroscopic and microscopic descriptions of nuclear rotations were considered more closely, which lead to a distinction between collective rotation and single-particle rotation. Experimentally it has been found that the collective ground-state rotational band in a deformed nucleus does not continue to be yrast at higher spin values. In other nuclei the yrast line, that is the envelope of yrast states versus spin, is found to be studded with high-spin isomers, corresponding to single-particle rotation. In general, single-particle configurations can to a first approximation be classified with reference to the nuclear ground state. Similarly, it turns out that the bands observed in rotational nuclei can be simply classified by their

quasiparticle configuration in a rotating frame of reference. On the other hand, the characterization of purely collective properties in terms of band patterns and a moment of inertia concept turned out to be one of the knottiest issues of this Symposium. Recently, not only the variation of the energy with the spin but also, alternatively, the variation of the rotational frequency with the spin has come to be expressed by a moment of inertia. This was essential to many of the analyses of the experimental results presented at the Symposium and a fair consensus developed concerning the terminology.

The available information about nuclear yrast and non-yrast excited states is being extended to higher spins over a wide range of nuclei. A more precise understanding of the collective and single-particle regimes is now well under way. The perspectives over the past and future were discussed and the span of one year in either direction was seen to be wide in relation to the rate of progress. Some ideas were regarded as consolidated and subject to deeper analyses while others were challenged and new ones proposed. The main controversy seems to be related to the fundamental nature of band structure and the character of the spectrum immediately above the yrast line.

This 50th Nobel Symposium on Nuclei at Very High Spin was opened on June 23, 1980, in Lund with the following proceedings being held at Örenäs Castle, by the shore of Öresund. The Symposium was arranged on the initiative of the late Professor Sven Gösta Nilsson, Lund, and dedicated to his memory. We would very much like to acknowledge the support, on many different aspects, of the Nobel Foundation and its Nobel Symposium Committee, the warm hospitality extended to the participants by the City Council of Lund and the significant contribution to the planning of the Symposium made by the International Advisory Group. It is our hope that the 50th Nobel Symposium has helped to set the course of future development and that the present collection of contributions to the Symposium will be useful for some time to come as a source of information, references and ideas.

Geneva, Switzerland and Tallahassee, Florida
in November 1980

Hans Ryde

Georg Leander