HIGH ANGULAR MOMENTUM PHENOMENA WORKSHOP IN HONOUR OF ZDZISŁAW SZYMAŃSKI*

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An introduction to the workshop at the Mazurian Lakes in honour of Zdzisław Szymański with a short discussion of the situation of nuclear physics in the physics world. The great influence of Zdzisław Szymański on the development of nuclear structure physics, both experimental and theoretical, is emphasized and exemplified with the development of high spin studies in the Rare Earth region.

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It is a great pleasure and honour for me to welcome you all to this workshop attached to the XXIV-th Mazurian Lakes School of Physics. The friends, colleagues and students of Zdzisław Szymański form a truly international family on nuclear structure physicists and we are here to-day to celebrate his approaching birthday. Zdzisław Szymański took the initiative to this series of schools almost thirty years ago, when times were not so easy, and these regularly arranged meetings came to be very important for bringing together young, as well as more established, nuclear physicists from different countries. New ideas were presented and discussed, often at a very early stage, new relations were created and cooperation stimulated. We are all thankful to Zdzisław for giving us these possibilities and for the very special, pleasant and creative atmosphere he introduced and which has become a tradition throughout the years.

Nuclear physics remains a frontier field of physics — a field with ever increasing linkages to other branches of physics and to broad-scale applications throughout technology and society. However, it seems to me that we,

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as nuclear physicists, are not always good enough at making the case for our science. We need more publicity for nuclear physics and we need to emphasize more clearly that we are an integral part of physics and science and to present ourselves more effectively as such. I know that in the Mazurian Lakes Schools of Physics there is never any lack of enthusiasm for nuclear physics, but we have to pass on this atmosphere to our fellow physicists around the world.

At a time of increasing worldwide pressure for relevance of research, and when there is a pendulum swing away from fundamental towards what is nowadays named strategic research we also have to emphasize the truly major contributions that our field has made to society. Since its very founding nuclear physics has been perhaps as closely coupled as any branch of physics to applications in all areas of technology. I need only mention nuclear energy and nuclear medicine.

The nucleus is a wonderful entity. It is complex enough to provide an inexhaustible supply of phenomena and yet simple enough so that, at least in principle, microscopic understanding is within our grasp. We have learned an enormous amount about the nucleus, but I am convinced that an enormous amount remains as yet unknown. We have reason to be proud of what we have accomplished thus far. We have contributed not only to fundamental knowledge about the nucleus but, through these studies, to a much better understanding of physics as a whole. We have shown repeatedly how our concepts and our instrumentation can, and indeed have, changed the face of science and of societies.

We have thus every reason to be celebrating some three decades around the Mazurian Lakes of remarkable accomplishment and I am convinced that by working together, as we are in the Mazurian Lakes School of Physics in the spirit set by Zdzisław Szymański, the discoveries and developments of the next thirty years will make those of the past pale by comparison.

Finally, allow me to be somewhat more personal emphasizing the influence Zdzisław Szymański has and has had especially on the development of experimental nuclear physics. He is here acting in Copenhagen tradition originating from the influence of Niels Bohr. He has thus, not least through Mazurian Lakes School of Physics, been able to guide generations of Polish theoretical as well as experimental physicists in using theoretical tools in the interpretation of experimental data. And this is valid not only for Polish physicists but also for many young people from other countries as a result of Zdzisław's taste for travelling and international contacts. Thus, I have personally enjoyed and benefited very much from the very pleasant and effective tutoring with Zdzisław as mentor during a common year at CALTECH as well as in Stockholm and Lund and other places.

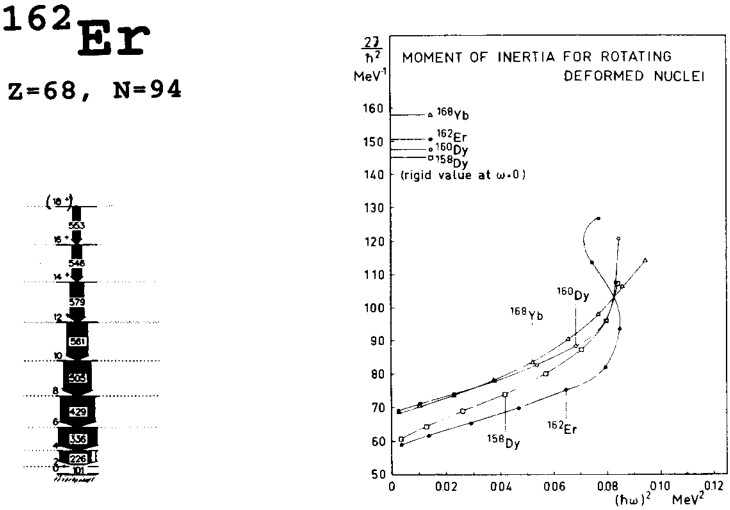

Fig. 1. Rotational levels in ^{162}Er known 1970 and plots of the moment-of-inertia.

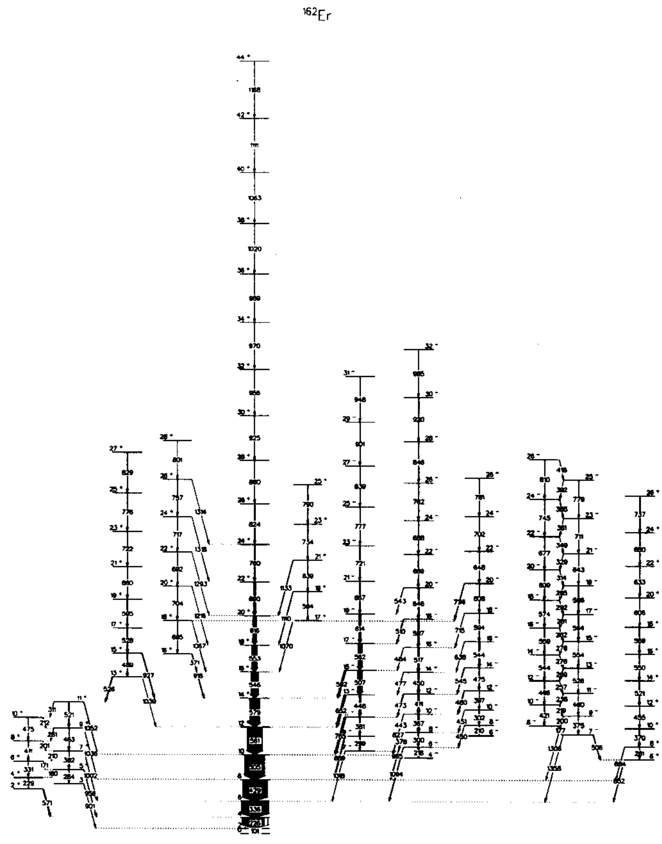

Fig. 2. Levels in ^{162}Er from recent experiments

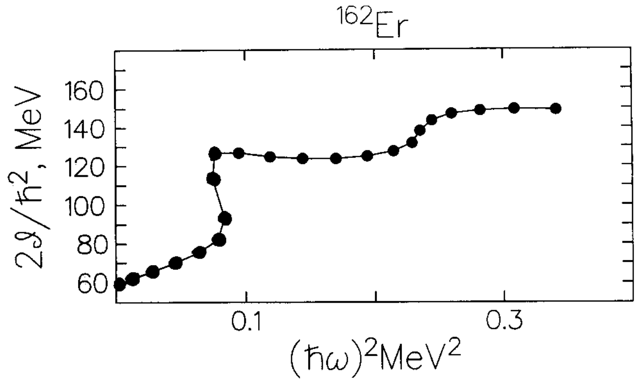

Fig. 3. The increase of the moment-of-inertia with rotational frequency for ^{162}Er.

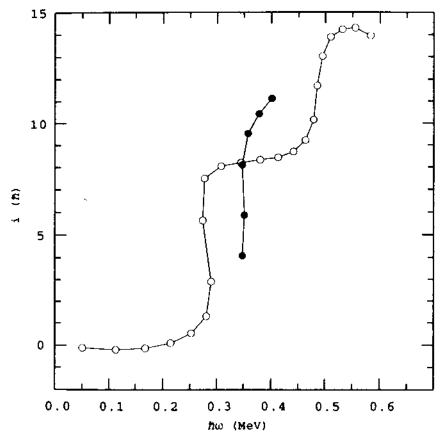

Fig. 4. The alignment of the $i_{13/2}$ neutrons and $h_{11/2}$ protons in ^{162}Er with increasing frequency. Open circles show the ground state band.

I cannot refrain from referring to our exciting days in Stockholm in the beginning of the seventies when Zdzisław spent a sabbatical year with us. His support during the process of interpretation of the first data concerning the backbending observed in ^{162}Er was decisive [1]. (Fig. 1) These data were obtained in an $(\alpha, 4n)$ reaction at 43 MeV, in which a level with spin 18 was reached. Nuclear physics is advancing and new experiments from the Liverpool–Manchester group [2], using a 170 MeV ^{36}S beam to populate high spin states in ^{162}Er, have reached a level with spin 44. Furthermore, several new side bands have recently been observed in a GASP experiment at Legnaro with an 85 MeV ^{18}O beam [3]. (Fig. 2) Most of us are enthusiastic about these new, added energy levels. However, we should remember that to most of our non-nuclear-physics colleagues this may appear both boring and analogous to stamp collection. We have to stress the new physics revealed by the new data. Thus, as an example, using the measured energies, the development of the moment-of-inertia for the rotating nucleus can be studied and such details as the alignment of quasi-particles investigated. In the ^{162}Er case the changes of the moment-of-inertia can be followed through the alignment of the first pair of neutrons, and first alignment of quasi-protons have now also been established. The moment-of-inertia seems for the highest rotational frequencies to have reached the rigid body value for the nucleus. (Fig. 3) To-day we often present such data as the alignment as a function of the rotational frequency. The values of the changes in alignment are then characteristic for the orbitals involved, namely in this case the $i_{13/2}$ neutrons and the $h_{11/2}$ protons. (Fig. 4) These data have also, at the highest rotational frequencies, been interpreted within the frame of the new spectroscopy in an unpaired regime.

In conclusion, there is still great adventure out here. So let us get on with it.

REFERENCES

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