

# Lecture Notes in Physics

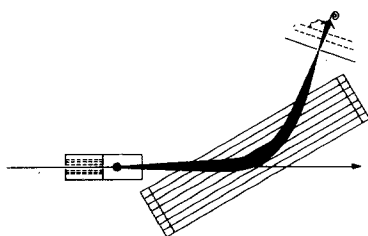
Edited by H. Araki, Kyoto, J. Ehlers, München, K. Hepp, Zürich  
R. Kippenhahn, München, H. A. Weidenmüller, Heidelberg  
and J. Zittartz, Köln

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## Forward Electron Ejection in Ion Collisions

Proceedings of a Symposium Held at the  
Physics Institute, University of Aarhus  
Aarhus, Denmark, June 29–30, 1984



Edited by K. O. Groeneveld, W. Meckbach and I. A. Sellin

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Springer-Verlag  
Berlin Heidelberg New York Tokyo 1984

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ISBN 3-540-13887-0 Springer-Verlag Berlin Heidelberg New York Tokyo  
ISBN 0-387-13887-0 Springer-Verlag New York Heidelberg Berlin Tokyo

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Printed in Germany

Printing and binding: Beltz Offsetdruck, Hemsbach/Bergstr.  
2153/3140-543210

## P R E F A C E

Since the coetaneous pioneering work of Crooks and Rudd at the University of Nebraska and of Harrison and Lucas at the University of Sussex on electron ejection at forward angles in ion-atom and ion-solid collisions, substantial and rapidly growing experimental and theoretical research concerning the physics of these processes has occurred. Because of the large volume of the new experimental and theoretical results, a two-day Symposium was held on related subjects hosted by the Physics Institute, University of Aarhus, Denmark, June 29-30, 1984. The present volume contains the Proceedings of this Symposium.

Because of his stature as one of the earliest investigators in the field, and his continuing theoretical development thereof and interest therein, it seemed appropriate to ask Joseph Macek of the University of Nebraska to deliver a keynote overview talk on the background and current status of underlying theory. Though a conflict in schedule prevented Professor Macek from favoring the Symposium with such a contribution, he offered instead to author a letter to be read at the Symposium summarizing his views of the field and its prospectus for continued development. As many of the sentiments expressed in his letter are shared by many other scientists, and indeed provide a worthy rationale for working in the field, this foreword seems the appropriate place to quote Professor Macek's principal observations.

"... Your invitation ... (offers) ... the opportunity to say a few words on the subject ... (of convoy electrons and related phenomena) ... a subject dear to my heart. The growth of this field, both in quantity and quality, is truly astonishing. The ingenuity of experiment is remarkable; new phenomena are uncovered so rapidly, it is difficult to keep up. Your workshop is timely in providing an assessment of where the field stands today. I only hope that somehow various contributions can be compiled so that those unfortunate enough to miss the occasion can benefit from your effort to bring this field together.

"In looking back over developments, it seems to me that the chief concept underlying the whole field of convoy electrons and similar phenomena is the recognition that there is really no sharp dividing line between reactions that produce bound states and those that produce 'free' electrons; they are both part of the complete picture of charge evolution in atomic collisions. It is heartening to see theorists such as Bottcher, Shakeshaft, Devia, and Grün producing maps of dynamical charge clouds to guide our thinking. On the experimental side, the complete maps produced by Professor Meckbach and co-workers are remarkable in the detail that they uncover. Above all, they show the rich structure that appears near the "forward peak".

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"That such structure is worthy of our attention is attested to by the theory of Spruch and Shakeshaft who pointed out implications of the forward peak for second Born theories of electron capture. This work, and its experimental confirmation by Sellin, Groeneveld and others, could not have been possible without the acceptance of the commonality that underlies reactions involving bound as compared with continuum states. The work of Dahl and Rodbrø was instrumental in affirming the continuity of phenomena across ionization thresholds. It is now appropriate to review what has been accomplished and thereby set the stage for new exploitation of these ubiquitous "convoy" electrons.

"As a final remark let us recall the important work of one who is unfortunately no longer with us. I refer to our dear colleague, Klaus Dettmann. At the time of early observations by Harrison and Lucas in Sussex and Crooks and Rudd at Nebraska, the enthusiasm and excitement of Klaus was infectious. I am convinced that he saw more clearly than any of us at the time where these new discoveries would take us. He would certainly be gratified, as all of us early workers are, to see what the field has become today."

The organizers of the Symposium are particularly indebted to the staff of the Physics Institute, University of Aarhus, and especially to Helge Knudsen, for providing excellent facilities and many amenities which did much to enhance the experience of the Symposium attendees, numbering about 45. Both the venue and the menu proved ideal.

Multinational government agency support of the Symposium is also gratefully acknowledged. Principal agency support was provided by U.S. National Science Foundation, Division of International Programs and Physics Division; by FRG agencies BMFT-Bonn and DFG-Bonn; by the Institute of Physics, University of Aarhus; and by the Danish Physical Society. The co-operation of the publishers Springer-Verlag in arranging expeditious publication of the Proceedings is also gratefully acknowledged.

-- K.O. Groeneveld, W. Meckbach, and I.A. Sellin, Editors --

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