

Proceedings of the Second Joint USA-USSR Symposium

Light Scattering in Solids

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Light Scattering in Solids

SECOND USA-USSR SYMPOSIUM ON
LIGHT SCATTERING IN CONDENSED MATTER
May 21-25, New York City

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PREFACE

The Second USA-USSR Symposium on Light Scattering in Condensed Matter was held in New York City 21-25 May 1979.

The present volume is the proceedings of that conference, and contains all manuscripts received prior to 1 August 1979, representing scientific contributions presented. A few manuscripts were not received, but for completeness the corresponding abstract is printed. No record was kept of the discussion, so that some of the flavor of the meeting is missing. This is particularly unfortunate in the case of some topics which were in a stage of rapid development and where the papers presented stimulated much discussion - such as the sessions on spatial dispersion and resonance inelastic (Brillouin or Raman) scattering in crystals, enhanced Raman scattering from molecules on metal surfaces, and the onset of turbulence in fluids.

The background and history of the US-USSR Seminar-Symposia on light scattering was given in the preface to the proceedings of the First Symposium held in Moscow May 1975, published as "Theory of Light Scattering in Condensed Matter" ed. B. Bendow, J. L. Birman, V. M. Agranovich (Plenum Press, N. Y. 1976). Strong scientific interest on both sides in continuing this series resulted in a plan for the second symposium to be held in New York in 1977. For a variety of reasons it was necessary to cancel the planned 1977 event, almost at the last minute. Despite this setback, the continued scientific enthusiasm for face-to-face interactions between American and Soviet scientists working in theory and experiment of "light scattering in a general sense" resulted in the second symposium coming to fruition in New York in 1979.

Now that two binational light scattering symposia have occurred, it is possible to take some stock of what has been achieved. The changing content of the two Symposia reflects changing emphasis of the field. Some topics continued to be emphasized such as: spatial dispersion (non-local effects) and phase transitions investigated by light scattering; others were

added such as; enhanced Raman scattering by molecules on metal surfaces and the onset of turbulence as studied by light scattering; some topics in which interest has waned such as studies on electron-hole drops do not appear.

Judging from reactions of participants, the exchange of new results, ideas and points of view was most worthwhile. The expansion of the circle of participants on both sides should be noted. The composition of participants (about half theorists and half experimentalists) reflects the ongoing vitality of this field as an active branch of contemporary Condensed Matter Physics.

Careful scrutiny of the topical contents of the two symposia emphasizes and illustrates the meaning of the term "light scattering in a general sense". In actual fact a more apt description of the subject area encompassed by these symposia is

"Optics of Matter - Light Scattering"

since the subjects continue to be: investigation of the physics and processes of radiation-matter interactions, the use of light as a weakly coupled probe of dynamical processes in matter, and the regimes of strong light-matter coupling such as a polariton and non-linear optical effects. A basis exists for continued and strong interaction between American and Soviet Scientists working in these fields, some of which has already been implemented as a result of the symposia in the form of joint research projects, long-term visits to laboratories and the like.

The practical implementation of the Second Seminar-Symposium was the result of the work and support of many individuals and organizations. Essential financial support was provided by the National Science Foundation - Division of International Programs; this and other support is gratefully acknowledged. Dean Harry Lustig, Science Division, City College, and President Harold Proshansky, Graduate Center, City University graciously extended scarce resources to assist the Symposium.

In this connection it is worthwhile to record the essence of some remarks made by (then) President Robert E. Marshak of City College, City University of New York, at the Symposium dinner calling attention to the fact that these Binational Symposia on Light Scattering have been outside the official "umbrella" of US-USSR science exchanges. In this way additional valuable channels of binational scientific cooperation have come into being.

It is a very pleasant duty to record thanks to the following persons who helped in various ways during the Symposium and also in bringing the Proceedings to fruition: Dr. L. Bureyeva, Mr. M. Belic, Dr. T. K. Lee, Dr. T. Odagaki, Dr. H. R. Trebin,

Dr. D. N. Pattanayak, Dr. W. Yao, Mrs. F. Tritt, Mrs. E. de Crescenzo, Mrs. N. Odagaki. The American co-editors are grateful to their Soviet co-editor, Professor K. K. Rebane for his continued help and assistance.

New York, 24 September 1979

Joseph L. Birman
Herman Z. Cummins

OPENING REMARKS

JOSEPH L. BIRMAN

City College of the City University of New York

It is a high privilege and pleasure for me to open the Second Binational Light Scattering Symposium. This 1979 Symposium in New York City follows the First Symposium in Moscow in 1975.

On behalf of the Organizers I express our greetings and welcome to all participants. We welcome our scientific colleagues from the Soviet Union and from all over the United States. We will do our best to make your stay at the Symposium and in New York as fruitful and pleasant as possible.

The subject of our Symposium is Light Scattering. We interpret this as the fundamental physics of the interaction of matter — especially condensed matter — and light. We are concerned with Light "Scattering" in a "wider" or "general sense". We include the investigation of composite excitations like polaritons, excitons, and magnons, as well as linear optics, non-linear optics, local optics, and non-local optics. A glance at the program shows the diversity of topics included, such as: physics of fluids and turbulence, physical processes in atomic systems, in crystals, in liquid crystals, and in lower dimensional systems such as surfaces and two dimensional crystals. The unifying threads are the basic physical process of radiation-matter interaction, and the dynamics of scattering in these systems.

The Organizing Committee has worked hard to make an exciting and high level program — from the first session on turbulence to the last one on "giant" or "enhanced" scattering from molecules on metal surfaces. Our Soviet colleagues also have an interesting program of laboratory and post-Symposium visits. Altogether a very exciting prospect for the next week or two.

Looking at the participants gathered here we may note the presence of practicing theorists and experimenters — or "experimenters well versed in theory". We note also some familiar American and Soviet scientists whom we already know from the First Symposium as well as others whom we hope to know during the days ahead.

Some of the several purposes of these Symposia were:

To strengthen and deepen American-Soviet scientific cooperation in Light Scattering;

To bring together experimenters and theorists, and

To continue to widen the circle of participants.

To some extent we have succeeded in these goals.

While we are so happy to greet those of you who have come, we must also remark on those absent. The absence of Professor Rem Khokhlov who died following a mountain climbing accident is particularly sad for us. He is greatly missed.

It is no great secret — as we note from the Band-Aid on the official folder — that originally we planned the Second Symposium in New York in 1977 — two years ago. But it was necessary to cancel that plan because of various impediments and also lack of vital communication between our two organizing committees. The coming to pass of this Symposium today is a result of improvements — both the removal of some impediments, and some better communication. Let us hope that this Symposium, and the Post-Symposium program will contribute to the continued removal of impediments, and the continued improvement in communications, — or as has been said: to the "free flow of scientists and scientific information". In this framework we look forward to further Symposia. We look forward to establishing cooperative research activities, and working groups, on this subject of Light Scattering, which is of great interest to scientists in America and the Soviet Union.

In a few moments we turn to the scientific program. Those of us fortunate enough to have participated in the First Symposium in Moscow remember many "hot" discussions there and look forward to hot discussions this week and next. For example, I myself recall hot discussions in Moscow with Professor Vitaly Ginzburg and I regret his inability to be present today. We hope indeed that there will be future Symposia in the United States and that Professor Ginzburg, and others will be present for them.

Now it is my happy duty to introduce Professor Karl K. Rebane, President of the Academy of Sciences of the Estonian S. S. R., Tallin, and Corresponding Member of the Soviet Academy of Sciences — who will make some remarks.

KARL K. REBANE

Academy of Sciences, Estonian S. S. R.

On behalf of the Soviet participants, I am pleased to say that we are really happy to be in the USA; to be in the great city of New York and to take part in our Second Joint Seminar-Symposium on the Theory of Light Scattering in Condensed Matter.

We arrived yesterday after a long flight in the late hours of the night by Moscow time. We were warmly met at J. F. Kennedy airport by Professor Birman and Professor Lax. Everything in the program for the beginning of our stay here was carefully and well prepared by the Organizing Committee, and its Chairman, Professor Cummins. Everything worked smoothly. All of that provided us with so much new energy of high quality, that already we do not feel the time difference any more and are eager to start with the work of the Seminar-Symposium.

Among our delegation are people who have already visited the United States and New York City before — some of us several times. For a considerable part of our group — it is the first visit to your country. But for all of us, to be here again, or for the first time, is very useful as physicists, or simply as people living in our contemporary world.

One more point. As we know very well — it is much easier and pleasant to be guests than to be hosts of scientific meetings.

We are grateful to our hosts here, at the Second Seminar-Symposium. We wish our hosts every success in their work; and we are, naturally, ready to be as cooperative as possible with the matters of the Seminar-Symposium and our stay here!

Thank you very much.

JOSEPH L. BIRMAN

It is also no secret that among the participants of this Symposium are scientists of the City University of New York. Today, tomorrow and Wednesday we meet in the Graduate Center of City University — which has some analogy to one building of Lomonsov Moscow State University where some of our sessions were held in 1975. On Thursday and Friday we meet in the building of the New York Academy of Sciences — analogous let us say to the "Scientists Palace" in Moscow the site of some other 1975 sessions. The New York Academy of Sciences building was formerly a private home — which was given to the New York Academy.

I should now like to introduce some academic officials and colleagues of City University;

President Harold Proshansky, President of the Graduate Center of City University who is our host here at the City University Graduate Center.

I note that President Robert Marshak of my own City College will be present at the Symposium Banquet, Wednesday evening and I will introduce him then.

I have great pleasure and honor to introduce Dr. Robert Kibbee, the Chancellor of the City University of New York, the highest administrative official of the University.

ROBERT J. KIBBEE
The City University of New York

Distinguished Colleagues and Visitors:

It is a great honor and privilege for the City University to serve as host to the second US-USSR Light Scattering Symposium; and a particular pleasure for me to bring greetings on behalf of the University Community to our distinguished guests from the Soviet Union and from throughout the United States. Several summers ago I had the pleasure of visiting the Soviet Union in connection with the meetings of the International Association of Universities held at the University of Moscow. I hope that in the next few days my University can provide our guests from the Soviet Union the same kind of generous hospitality I received at Moscow.

Light Scattering is, of course, a technical term in the language of physics that encompasses various phenomena which will be discussed during your meetings. Yet this technical term is comprised of two common English words which, if reversed, speak to the very purpose of a University and to the heart of scholarly activity. The Scattering of Light about the nature and purpose of our universe, about the development and meaning of different cultures, about the human condition, and about how man reacts and adapts to his environment is what absorbs the energy of scholars and artists.

What absorbs us most as nations and as people is the elusive but cherished goal of international peace — a condition achieved when nations understand each other better, trust each other more and can work together for a common good. Meetings such as this contribute positively to this end and reflect the improved environment between our two great nations. For this reason it is of great significance to us to be your host.

Your presence further honors the University because of the value we place on the scientific endeavors in which you are engaged. The very fact that this Symposium is occurring under our aegis gives testimony to the commitment of the University, and especially of the City College, to the field of physics.

The president of City College, who sadly soon will be leaving us — Robert Marshak — is himself a world renowned Particle Physicist and he is also a moving force in the opening up of scientific exchanges between the United States and the Soviet Union, of both of which facts I am sure you are all well aware. Indeed, it is likely that we would all not be here this morning if it were not for the tireless efforts of President Marshak in the building of a superb science faculty at City College and in pressing for improved relations between the scientific communities of our two countries.

I would also like to take this opportunity to extend our gratitude to the two professors most responsible for bringing this Symposium to the University: Chairman of your Executive Committee, Professor Joseph L. Birman, and Chairman of your Organizing and Program Committee, Herman Z. Cummins.

You have come from great distances to meet with each other and share ideas and research. I do not wish to take any more of your time.

Let me again say welcome on behalf of the City University of New York, — it is a great privilege to have you amongst us.

JOSEPH L. BIRMAN

I now end the introductory Opening Session.

I open the scientific meeting. I ask the two co-chairmen to come forward. Professor Lev Pitaevskii of the Institute for Physical Problems; Professor Paul Martin of Harvard University.

21 May 1979

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