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К ТРИДЦАТИЛЕТИЮ КАФЕДРЫ
ТЕОРЕТИЧЕСКОЙ ФИЗИКИ

НАУЧНЫЕ ПУБЛИКАЦИИ

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Irkutsk State University

TO THIRTIETH ANNIVERSARY OF THE
DEPARTMENT OF THEORETICAL PHYSICS

SCIENTIFIC PUBLICATIONS

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Предисловие

Основные направления научной деятельности кафедры теоретической физики физического факультета Иркутского государственного университета в настоящее время связаны с физикой элементарных частиц, включая физику космических лучей и нейтринную астрофизику. Эта тематика возникла на кафедре в 1969 г. по инициативе известного ученого, одного из крупнейших специалистов в области квантовой теории поля, академика Д. В. Ширкова и ректора ИГУ профессора Н. Ф. Лосева, как адекватная основа для подготовки специалистов по фундаментальной физике в ИГУ. С этой целью на постоянную работу в ИГУ были приглашены сотрудники отдела теоретической физики Института Математики им. Соболева (Новосибирск) И. И. Орлов, Ю. В. Парфенов, А. Н. Валл и В. Л. Черняк, которые и возглавили всю дальнейшую работу по реорганизации кафедры, разработке учебных планов, постановке основных курсов теоретической и математической физики и спецкурсов по физике элементарных частиц, квантовой теории поля и т.д.

В 1972 кафедра, совместно с лабораторией теоретической физики Объединенного Института Ядерных Исследований (Дубна) и Институтом Математики им. Соболева (Новосибирск), провела в Иркутске международную конференцию по физике низких энергий. Подобные конференции стали впоследствии традиционными на протяжении многих лет.

Следующим важным этапом в научной жизни кафедры стала международная конференция, проходившая в поселке Листвянка у озера Байкал в 1979 г. Эта конференция являлась частью международного конгресса по океанологии и была посвящена проблеме детектирования природных потоков мюонов и нейтрино в рамках совместной Советско-Американской программы. Именно на этой конференции академиками М. А. Марковым и А. Е. Чудаковым была высказана идея об использовании бассейна оз. Байкал в качестве базы для отработки экспериментальных узлов полномасштабной установки, которую предполагалось создать в Тихом Океане у побережья Гавайских островов. Таким образом было положено начало собственно Байкальского эксперимента NT-200, который в настоящее время успешно развивается и получил широкое международное признание. Одновременно сотрудниками кафедры, совместно с коллегами из Института Ядерных Исследований АН СССР (Москва), были начаты теоретические исследования проблемы генерации и переноса мюонов и нейтрино космических лучей. Очень быстро на кафедре сформировалось самостоятельное направление теоретических исследований по физике космических лучей и нейтринной астрофизику. Результаты многолетней работы по данной тематике используются сегодня во многих областях “неускорительной физики частиц” и служат хорошей основой для подготовки молодых специалистов в этой области науки.

Как научную, так и педагогическую работу кафедра проводила и ведет в тесном сотрудничестве с ведущими научными центрами России, такими как Институт Ядерной Физики им. Будкера и Институт Математики им. Соболева (Новосибирск), ОИЯИ (Дубна), ИЯИ РАН (Москва), а так же с университетами Петербурга, Томска, Новосибирска. После окончания университета

и аспирантуры выпускники кафедры продолжают успешно работать в научных учреждениях России и за рубежом (в частности, в Италии, Швейцарии, США, Канаде). Ежегодно кафедра выполняет научно-исследовательские работы в рамках нескольких грантов, а ее сотрудники – постоянные участники международных конференций. Осенью 1998 г. кафедра активно участвовала в организации и проведении первой в Иркутске Школы по фундаментальной физике для молодых ученых “Астрофизика и Физика Микромира”, собравшей более сотни слушателей и 10 приглашенных лекторов из России, Италии и Германии.

За период с 1969 по 1998 гг. сотрудниками кафедры (совместно с аспирантами и студентами) опубликовано около 500 научных работ, учебных и учебно-методических пособий. Ниже приведен список научных публикаций кафедры за последние 5 лет. Тематическое разделение материала в значительной мере условно, поскольку многие работы посвящены проблемам, находящимся “на стыке наук”. В частности, это относится к работам, выполненным в рамках международных проектов “Baikal NT-200”, “NESTOR”, “L3+Cosmics” и к исследованиям, проводившимся на университетском γ -телескопе в Тункинской долине; все такие работы условно отнесены к разряду “экспериментальных”. Работы по ядерной физике, ядерной астрофизике и некоторым специальным проблемам теоретической физики отнесены к разделу “Разное”.

**Заведующий кафедрой теоретической физики,
профессор А. Н. Валл**

Иркутск, 1999



Preface

Basic directions of the scientific activity of the Theoretical Physics Department of Irkutsk State University's (ISU) Physics Faculty currently center around (but not restricted to) high-energy particle physics, including cosmic-ray physics and neutrino astrophysics. This line of investigation originated with an initiative of academician D. V. Shirkov, an internationally known expert in quantum field theory, and of professor N. F. Losev, the chancellor of ISU. High-energy physics was considered an appropriate ground for the education in fundamental physics at the University. For this purpose, several researchers from the Theoretical Physics Department of Sobolev Institute of Mathematics (Novosibirsk) were offered work at ISU. From 1969, these researchers, Drs. I. I. Orlov, Yu. V. Parfenov, A. N. Vall, and V. L. Chernyak, led the overall work on the re-organization of the Department, development of the curriculum, and arrangement of fundamental (required) studies in theoretical and mathematical physics as well as specialized courses in high-energy physics, quantum field theory, and related subjects.

In 1972 in Irkutsk city, the Department, jointly with Laboratory for Theoretical Physics of Joint Institute for Nuclear Research (Dubna) and Sobolev Institute of Mathematics (Novosibirsk), conducted an International Conference on Low-Energy Particle Physics. Since then such meetings had been traditional for many years.

The next significant event in the scientific activity of the Department was an International Conference on Deep Underwater Detection of Muons and Neutrinos that was held in Listvyanka village near Lake Baikal in 1979. This conference was a part of an International Oceanological Congress within the framework of the joint Soviet-American scientific program. That was the conference where academicians M. A. Markov and A. E. Chudakov came up with a proposal for utilizing the Baikal lakescape as a testing area for the development of experimental segments of the full-scale apparatus that was planned to deploy in the Pacific Ocean near Hawaii Islands. In fact the conference marked the beginning of the independent Baikal neutrino experiment. Today it has progressed rapidly and gained an international recognition. Simultaneously, theoretical studies of the cosmic-ray muon and neutrino production and transport through matter were started by researchers from the Department in collaboration with their colleagues from a laboratory of Institute for Nuclear Research, Academy of Science of USSR (Moscow). In short order a fully substantive line of investigation on cosmic rays and neutrino astrophysics came into being. Results of the long-term research are now of the considerable current use in several divisions of "astroparticle" physics. Furthermore, the research achievements have provided a good ground for the training of young researchers in the field.

Both teaching and scientific work in the Department are performed in a close collaboration with the leading Russian institutions, such as Budker Institute of Nuclear Physics and Sobolev Institute of Mathematics (Novosibirsk), Joint Institute for Nuclear Research (Dubna), Institute for Nuclear Research of Russian Academy of Science (Moscow), as well as with St.-Petersburg, Tomsk, and Novosibirsk Universities. Many graduates of the Department work successfully in scientific institutions in Russia and abroad (Italy, Switzerland, Israel, USA, and Canada). Annually, the Department fulfils scientific researches within the framework of several grants;

members of the Department regularly participate in international scientific conferences. In autumn 1998, the Department took an active part in the preparation and work of the first Irkutsk School on Fundamental Physics for young researchers called “Astrophysics and Physics of Microworld.” The School brought together more than 100 listeners and 10 invited lecturers from Russia, Italy, and Germany.

During the period from 1969 to 1998, the staff of the Department, together with its students and post-graduates, had published about 500 scientific articles, several textbooks and teaching aids. Below is a list of scientific papers published over the past 5 years. The topical division of the material is to a large extent relative because many studies have been dedicated to problems linking several fields. It is particularly true of the pieces of work fulfilled for or within the international collaborations “Baikal NT-200”, “NESTOR”, and “L3+Cosmics”, as well as for experiments with γ telescope at Tunka valley; all such works are arbitrarily called “experimental”. Papers on nuclear physics, nuclear astrophysics, and on some particular problems of theoretical physics are placed to subsection “Miscellaneous”.

**Head of the Theoretical Physics Department,
Professor A. N. Vall**

Irkutsk, 1999



List of collaborators

- E. G. Aman – senior lecturer
- E. M. Bol'shedvorsky – post-graduate student
- E. N. Bukina – former post-graduate student now researcher in JINR, Dubna,
- K. A. Dyrgyallo – post-graduate student
- A. E. Kaloshin – associate professor
- V. A. Karnakov – associate professor
- S. E. Korenblit – associate professor,
- K. S. Kuz'min – student engaged on degree thesis
- V. E. Kuznetsov – former student, now researcher in JINR, Dubna,
- V. M. Leviant – senior researcher (Lab. of Theoretical Physics)
- S. V. Lovtsov – associate professor
- Yu. I. Lyaudinskaite – post-graduate student
- B. V. Mangazeev – associate professor
- D. V. Naumov – post-graduate student
- V. A. Naumov – head of Lab. of Theoretical Physics
- Yu. V. Parfenov – professor, head of Physics Faculty
- E. V. Pavlova – post-graduate student
- V. M. Persikov – senior lecturer
- S. I. Polityko – associate professor
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- A. E. Rastegin – post-graduate student
- N. V. Shevchenko – post-graduate student
- T. S. Sinegovskaya – post-graduate student
- S. I. Sinegovsky – associate professor
- A. V. Sinitskaya – former post-graduate student, now lecturer
- A. B. Tanaev – post-graduate student
- A. N. Vall – professor, head of Department of Theoretical Physics

List of Publications

I. Theoretical investigations

Cosmic-Ray Physics and Neutrino Astrophysics

1. V. A. Naumov, Cosmic-ray neutrinos at low and intermediate energies, in *Proceedings of the International Workshop on “ ν_μ/ν_e Problem in Atmospheric Neutrinos”*, Gran Sasso, Italy, March 5–6, 1993, edited by V. S. Berezinsky and G. Fiorentini (LNGS, L’Aquila, Italy, 1993), pp. 25–70.
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 10. S. I. Polityko, N. Takahashi, M. Kato, A. Misaki, **High and extremely high energy muons accompanied by electromagnetic cascade shower**, in *Proceedings of the RIKEN International Workshop on Electromagnetic and Nuclear Cascade Phenomena in High and Extremely High Energies*, Tokyo, Japan, December 22–24, 1993, edited by M. Ishihara and A. Misaki (RIKEN, Tokyo, 1994) pp. 414–425.
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Quantum Field Theory and Bound State Problem

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¹PostScript file is available through URL <http://www.api.isu.ru/school/BSYPH/Proceed-BSYPH-98.html> or <ftp://62.76.7.203/incoming/BSYPH-98>.

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Electrodynamics of Hadrons

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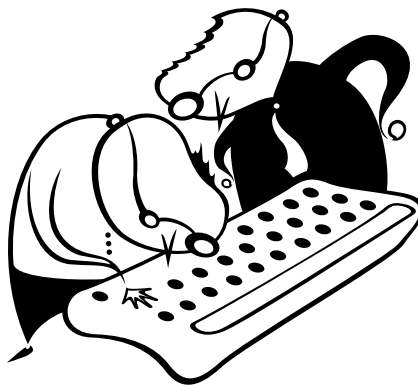
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