Shigeo Katsu
President of «Nazarbayev University»

Dear guests, colleagues and conference participants!

Let me express on behalf of Nazarbayev University our appreciation to the scientists of Lawrence Berkley National Laboratory (LBNL) for your active support in the preparation of Heavy Ion Fusion/High Energy Density Physics (HIF/HEDP) Accelerator Facility Workshop and for your willingness to share your ideas and experience with our colleagues.

This important event is a result of two-years of close collaboration between scientists at Nazarbayev University's Center for Energy Research (NURIS) and LBNL.

During this time, a substantial progress was achieved, and the stage is set to explore wider ranges of plans, to set new goals and specific objectives in developing concrete directions for Nazarbayev University as a Research University. A starting point for the successful development of Nazarbayev University will be the further exchange of research ideas covering different disciplines such as physics, materials science and engineering.

At this conference we will discuss issues related to the study of plasma physics, critical states of matter, inertial fusion and others (technology transfer, education and training of personnel) between representatives of Kazakhstan and the USA.

In addition, we will explore how to ensure that we will implement joint projects at Nazarbayev University.

The HIF/HEDP Accelerator Facility Workshop will serve as a platform for discussing these issues. We hope that it will bring fundamental research to a new level in the field of physics.

I wish you all a successful and effective workshop, and trust that the outcome will be beneficial for us all! Welcome!

Dr. Joe Kwan
Physicist, Lawrence Berkeley National Laboratory
Workshop Chairman

The inertial fusion is one of the ways to develop commercial thermonuclear reactors. To achieve conditions for thermonuclear fusion we need very high temperature and pressure at the target. One of the ways to achieve these conditions is heating the target by multiple high-power ion beams. To do so, the ion beam must be compressed to a pulse length of a nanosecond and focused to a spot size of a few mm. In order to overcome the beam's space-charge dominated Coulomb repulsion before reaching the target, the ion beam will propagate through a neutralizing plasma.

Proposed research facility will be an alternate version of the existing "Neutralized Drift Compression Experiment (NDCX-II)", intended to study the feasibility of using compressed high intensity ion beams for inertial confinement fusion.

This unique setup can be easily modified and complemented with additional modules. Uniqueness of NDCX-II is the ability to produce high intensity ion beam pulses in the time range of 0.5-1 nanoseconds, which will allow multipurpose uses in pioneering research in many areas of physics.

Planned upgraded system has unique world-class technical parameters, and will attract researchers from laboratories in developed countries worldwide.

Dr. Kanat Baigarin
PGeneral Director of «Nazarbayev University Research and Innovation System»
Workshop Co-Chairman

Dear colleagues!

The project aims to do research in the field of plasma energy, nuclear fusion, the supercritical state of matter and new materials in collaboration with LBNL, where world-class research infrastructure and intellectual human resources will be trained and involved for its implementation at Nazarbayev University.

The main stages of project realization/implementation are: establishment of the center of high energy physics based NDCX-II ion accelerator – in collaboration with Kazakh and world community researchers, which will give an access to unlimited source of clean energy; foundation and development of interdisciplinary laboratories in high energy physics, materials science, laser physics and engineering center.

We hope that the collaboration between LBNL and Nazarbayev University will allow us to create a model of National Laboratory in identifying priorities of Kazakhstan's science.

I am convinced that this first conference will be fruitful and mutually beneficial as well as become a discussion platform in solving identified problems.

PROGRAM OF THE WORKSHOP 25 - 26 JUNE, 2014
HIF/HEDP NDCX-NU Research Facility

Wednesday 25 June

09:50	**Welcome –** Government and NU officials, Kanat Baigarin, Joe Kwan	Senate Hall
10:15	**Introduction workshop participants –** *Joe Kwan, Alexander Tikhonov*	Senate Hall
10:30	**Explain the charges and format of this workshop** *Joe Kwan*	Senate Hall
10:45	**Coffee Break and Press time**	Senate Hall
11:15	**"Status of IFE & HIF"** *Grant Logan, via video link*	
11:45	**"Status of Kazakhstan effort in nuclear science and fusion research (Tokamak, etc)."** *Mazhyn Skakov, Anuar Sadikov*	Senate Hall
12:25	**"NDCX2 as an ion driver for HEDLP studies"** *Joe Kwan*	Senate Hall
13:00	Lunch	
14:30	**"NDCX-NU goals, plans, and status"** *Alexander Tikhonov, Kanat Baigarin*	Senate Hall
15:00	**"Status of Ion-Driven HEDLP"** *Dieter Hoffmann*	Senate Hall
15:30	**"HED Laboratory Science at Intermediate-scale Laser Facilities"** *Bob Cauble*	Senate Hall
16:00	Coffee break and informal discussion	9151
16:30	**"NDCX2 commissioning and scientific goals"** *Peter Seidl*	Senate Hall
17:00	**"NDCX2 and Intense Beam Physics"** *Igor Kaganovich, via video link*	Senate Hall
17:30	Round table NDCX-NU concept discussion (I) + Coffee time (Joe and Kanat to lead)	Senate Hall

Thursday, 26

10:00	**"HEDLP target experiments and diagnostics"** *Pavel Ni*	1204
10:30	**"NDCX2 and WDM numerical simulations"** *Enrique Henestroza*	1204
11:15	**"NDCX2 facility design and technology"** *Will Waldron*	1204
11:45	Group Photo	1204
12:00	Coffee break	
12:15	**"Accelerators in Kazakhstan"** *Maxim Zdorovetz*	1204
12:45	**"Nonlinear dynamics in high energy accelerators"** *Giorgos Tsironis*	1204
13:15	Lunch	
14:30	Visit of NU Research Facilities	TBD
15:15	**"Engineering and management of Major Projects"** *Alex Ratti*	1204
15:45	**"Engineering facilities and projects at NU"** *NU engineer*	1204
16:15	Meeting with NU and other KZ officials	TBD
17:15	Round table NDCX-NU concept discussion (II) + Coffee time (Joe and Kanat to lead)	1204

FUTURE ENERGY
WORKSHOP

HIF/HEDP NDCX-NU ACCELERATOR FACILITY

NAZARBAYEV UNIVERSITY
RESEARCH AND INNOVATION SYSTEM

ASTANA 2014 — BERKELEY LAB Lawrence Berkeley National Laboratory — JUNE 25-26

Guests (non-Kazakhstan participants)

Dr. Joe W Kwan – He received his PhD in Physics from University of British Columbia, Canada, in 1982. In 1983 he joined Lawrence Berkeley National Laboratory and had been working there as a senior staff scientist until retirement in June 2013. In the beginning, he worked on developing ion sources and neutral beam injectors for magnetic fusion reactors. Later on he worked in heavy ion fusion induction linacs. During 2009 to 2012, he was the project director for NDCX2 overseeing its design and construction. In early 2012, he became Head of the Fusion Energy Research and Ion Beam Technology Program at LBNL.

Dr. Pavel Ni – is an experimental physicist with a background in solid state-, nuclear- and plasma physics. He graduated with MS from Moscow Institute of Technology in 2002 and received his Ph.D. in 2006 from Technische Universitaet Darmstadt, Germany. Presently he became a staff scientist at the Lam Research Corporation working in PECVD and thin film metrology/process projects. He has over 10 years of experience in academia doing fundamental research in LBNL, LLNL, etc. and over three years of experience in the private sector, working on various consumer and industrial products His areas of expertise include plasma physics, shock physics, high-energy density physics, inertial confinement physics, laser physics, heavy-ion/matter interaction, beam dynamics physics, accelerator design, spectroscopy of dense plasma, material processing, ion sources development, R&D of scientific instruments.

Dr. Dieter HH Hoffman is Full-Professor of Technical University Darmstadt and Head of Radiation and Nuclear Physics Department. Scientific interests: Accelerator physics and technology, astroparticle physics, high energy density plasma physics and nuclear physics. He got Ph.D of Technische Hochschule Darmstadt in 1979. He made post-Doc at Alexander-von-Humboldt Foundation of Stanford University, California, USA in 1979-1981. He has academic awards-Dr. of Technical Sciences honoris causa, Russ. Acad. Sc. In 1999 and Honorary Professor Xianyang Normal University, China in 2009.

Dr. Peter A Seidl received a BS in Physics from McGill University in 1980 and a PhD in Nuclear Physics in 1984 from The University of Texas at Austin. He worked on numerous pion, electron, proton, and heavy ion scattering experiments at LAMPF, ANL, SLAC, and Berkeley Lab. After designing and using detectors for heavy ion collisions at the Bevalac, he joined the Heavy Ion Fusion group at Berkeley Lab in 1991. He was the lead physicist of various experiments for HIF drivers and for warm dense matter research, and supervised several graduate students. His current research is on intense beam physics, materials studies and warm dense matter physics using NDCX-II.

William L Waldron is a high voltage and pulsed power engineer at Lawrence Berkeley National Laboratory supporting the Fusion Science and Ion Beam Technology Program as well as other accelerator and high voltage projects. He was the project manager and lead engineer for the NDCX-II design and construction project and continues to design and manage upgrades to the facility. He received his M.S. in Nuclear Engineering from U.C. Berkeley and his B.S. in Electrical Engineering from the University of Virginia. His scientific interests include power modulators, switching technologies, applied electromagnetics, induction accelerators, and diagnostics for beams and pulsed power systems.

Alessandro (Alex) Ratti is a project manager and RF Engineer and leads the Advanced Technologies Group in the Engineering Division of Lawrence Berkeley National Laboratory, a group dedicated to the development of custom electronics solutions for scientific discovery. Alex coordinates the US contribution to the deflecting cavities, one of the major elements of the proposed upgrade of the Large Hardon Collider (HL-LHC), a role that resulted from the experience leading the US contributions to the beam instrumentation systems of the LHC. Alex graduated in Electrical Engineering at the Universita' degli Studi di Pavia (Italy), working on a thesis on the warm model of the quarterwave cavities for the superconduction linac at the Laboratori Nazionali di Legnaro. He also holds an MBA from the Haas School of Business, University of California, Berkeley.

Dr. Igor Kaganovich is the Deputy head of the PPPL Theory Department, Principal Physicist at PPPL. Professional interests include: plasma physics with applications to nuclear fusion (heavy ion fusion), gas discharge modeling, and plasma processing, kinetic theory of plasmas and gases, hydrodynamics, quantum mechanics, nonlinear phenomena and pattern formation. Dr. Kaganovich is APS fellow and was the recipient of the Alexander von Humboldt Fellowship in 1996, published more than 90 papers, including > 10 Phys. Rev. Letters, h-index> 20. His research was supported by individual grants from international and national funding agencies including DOE, NSF, AFSOR, INTAS, ISF, and RFBR. He received his B.S. and M.S. from Physical- Mechanical Department of St. Petersburg Technical University, and Ph.D. from Ioffe Physical Technical Institute. With regard to NDCX-II main interests includes collective effects and beam- plasma interactions, theory and simulations in close coupling with experiments and experiments planning.

Dr. Enrique Henestroza – obtained his B. Sc. Degree from the National University of Mexico and his Ph. D. Degree in Physics from the Massachusetts Institute of Technology. Dr. Henestroza's field of expertise is in the design, numerical modeling and analysis of experimental data of high intensity particle beam accelerators for High Energy Density Physics, including applications in Heavy Ion Inertial Fusion and Warm Dense Matter Physics. Over the past 25 years he has worked on several projects in the fields of High Energy Density Physics, Heavy Ion Fusion, Radiation Hydrodynamics, Target Physics, Lase-Plasma Interactions, Medical Accelerators, Neutron and Gamma-Ray Sources for Homeland Security, as well as other beam dynamics and accelerator physics topics including electromagnetic and thermal analysis of physical processes. He did the original physics design of the NDCX-II accelerator for Warm Dense Matter applications. At the present time Dr. Henestroza is providing consulting work for scientific projects.

Dr. Robert C. Cauble - Director of the Jupiter Laser Facility He received his B.S. in physics in 1974 from the University of Arizona and his Ph.D. in nuclear engineering from the University of Michigan in 1980. Cauble worked at the Naval Research Laboratory on theoretical predictions of the effects of high-density plasma on atomic transitions and particle transport. He came to LLNL in 1986 to work on projects to produce atomic models for plasma simulations and to design and analyze experiments to use laboratory x-ray lasers as high-density-plasma probes and interferometers. He then worked on large-scale simulations and designs of experiments to elicit material properties, mainly equation-of-state data at extreme pressures using intense, laser-driven shocks. From 2001-2008, he led the condensed matter division in the Physics Directorate at LLNL and from 2008 on has served as Director of LLNL's Jupiter Laser Facility.

Dr. Grant Logan - After receiving his Ph.D. from UC Berkeley in 1972, he conducted research in magnetic and inertial fusion energy, first at Lawrence Livermore National Lab and later at Lawrence Berkeley National Lab. He has received many awards including the E. O. Lawrence Memorial Award (1980), APS Fellow (1980), Fusion Power Associates Leadership (1999) and Distinguished Career Award (2012). He was the head of the Fusion Energy Science Program at LBNL, and the Director of US Heavy Ion Fusion Science Virtual National Lab until retirement in 2012.

Kazakhstan participants
The participants from Nazarbayev University Research and Innovation System and School of Science and Technology

Dr. Kanat Baigarin - General director of Nazarbayev University Research and Innovation System. He gained Ph.D. in physics and mathematics in 1989 at I.V.Kurchatov Institute of Atomic Energy in Moscow. He has more than 60 scientific publications. Dr. Baigarin started his working career in 1975 at I.V. Kurchatov Institute of Atomic Energy, Moscow. Since 1990 he was the Head of Laboratory of the Institute. Dr. Baigarin was the associate of the International Program Leadership on Environmental and Development (LEAD) in 1993-94. Also he has served as a consultant to the Global Environment Division of Rockefeller Foundation on energy efficiency and renewable energy project in the CIS, to UNDP and Word Bank on Renewable Energy in Central Asian countries. In 1997 he together with ECN (Netherlands) finalized Market Development Study for Wind Energy in Kazakhstan.

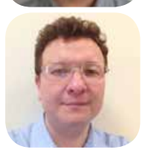
Dr. Alexander Tikhonov - Director of Center for Energy Research at Nazarbayev University Research and Innovation System and Acting Chair and Assistant Professor of Department of Physics, Nazarbayev University. He received a MS from Moscow Institute of Physics and Technology, Russia in the field of experimental Laser Physics. He got a Ph.D. in 2006 from the University of Pittsburgh, USA. Since 2006 he was a posdoc and then becomes a Research Assistant Professor at University of Pittsburgh. He works in both theory and experiment in the fields of photonic properties of nanomaterials and molecular electronics. His personal recent research focuses in fabrication, characterization and applications of photonic colloidal crystals.

Dr. Giorgos P. Tsironis - Department of Physics, University of Crete and Foundation of Research and Technology-Hellas (FORTH).George Tsironis obtained his BSc in Physics from the Univ. of athens in 1981 and his PhD in Theoretical Condensed Matter Physics from the Univ. of Rochester (USA) in 1987.He was Assistant Professor at the Univ. of North Texas before joining the Univ. of Crete in 1994 as an Associate Professor. He became Full Professor in 1999. He served as the Chairman of the Department of Physics from 2007 until 2011. Scientific interests: G. Tsironis has worked extensively in nonequilibrium statistical mechanics and nonlinear physics. In these areas has made contributions to noise induced transitions and noise induced spatial symmetry breaking and has applied some of these ideas in directed motion of motor proteins. In recent years he works primarily on the physics of conventional and superconducting metamaterials.

Sergey Tikhonov – Chief Engineer at Nazarbayev University Research and Innovation System. He graduated in 1990 with MS from the Department of Radio Physics of Nizhniy-Novgorod University, Russia. He then worked as an experimental plasma physicist in the Institute of Applied Physics, Nizhniy Novgorod. From 1993 he holds various business and engineer leadership positions in construction industry.

Dr. Boris Fine - Professor, Department of Physics, School of Science and Technology, Nazarbayev University. Research interests: Dynamics-to-statistics and quantum-to-classical transition in nonequilibrium many-body systems; chaos, decoherence, foundations of quantum statistical physics; spin dynamics, spin-spin relaxation in nuclear magnetic resonance (NMR); high-temperature superconductivity, stripes/inhomogeneities in high-Tc cuprates;

Dr. Dmitriy Beznosko - Assistant Professor, Department of Physics, School of Science and Technology, Nazarbayev University. He received his B.S. in astrophysics in 2002 from the State University of New York at Stony Brook, NY, his M.S. in physics from the Northern State University of Illinois in 2004 and his Ph.D. in physics from the State University of New York at Stony Brook in 2011. His research interests are mostly concentrated around experimental HEP and novel photo detectors and data acquisition systems.



Dr. Zhandos Utegulov - is Assistant Professor of Physics at Nazarbayev University (NU). Prior to joining NU he was holding several research posts at Idaho National Laboratory, University of Nebraska-Lincoln, National Institute of Standards and Technology in Boulder, Colorado and University of Cincinnati. He obtained his PhD in Condensed Matter Physics/Laser Spectroscopy in 2003, MS in Photonics from Oklahoma State University in 1999 and diploma in Physics from Kazakh National University in 1996. His research interests are in condensed matter physics and laser-matter interaction with the focus on fast time-resolved laser-acoustic and photo-thermal techniques, beam-induced phase transitions and in-situ optical diagnostics, inelastic laser (Raman and Brillouin) light scattering spectroscopy, surface plasmon-enhanced spectroscopy and optical nano-metrology.

Dr. Zinetula Insepov - Head of Laboratory of Nano Synergy at NURIS. He currently works as an adjunct professor at the School of Nuclear Engineering at Purdue University and a Founding Faculty Fellow at Skolkovo/MIT initiative. Developed a new cluster ion beam technology at Kyoto University (1992-2003, Japan). Developed new fission reactor materials at Argonne National Laboratory and for ITER materials at Purdue University (2003-now). Scientific interests: plasma physics, high-gradient accelerators, ITER, nanotechnology, nuclear fuel and structural materials, ion beam materials processing. He got MSc in semiconductor engineering from the MPEI (Russia), Ph.D. in semiconductor physics from Lebedev Physics Institute and «Doctor of Science» from Semyonov Chemical Physics Institute.

Dr. Aliya Nurmukhanbetova - Head of physics and material science laboratory at Nazarbayev University Research and Innovation system. Scientific interests: nuclear physics, astrophysics and accelerators. She got MSc in physics from Kazakh National University in 2006 and PhD in physics from Gumilyov Eurasian National University in 2010.

Dr. Arshat Urazbayev - Senior researcher of physics and material science laboratory at Nazarbayev University Research and Innovation system. He got MSc (2003) and PhD in plasma physics from Moscow Institute of Physics and Technology, Russia in 2006. Research interests: plasma physics, fusion energy and tokamaks.

Dr. Mendykhan Khassenov - Senior researcher at Laboratory of Physics and Material Science at Nazarbayev University Research and Innovation system. He graduated from the Moscow Institute of Physics and Technology (MIPT) with a MS in 1975. He got his Candidate of Science degree (Ph.D. equivalent) at 1982 from MIPT. His research interests are the physics of gas lasers and laser technology. He performed research on nuclear-pumped lasers and nuclear-induced plasmas of gas mixtures on a stationary nuclear reactor WWR-K of the Institute of Nuclear Physics.

Dr. Maxim Kozlov – Senior researcher of physics and material science laboratory at Nazarbayev University Research and Innovation system. He got PhD in Mechanical Engineering from University of Rochester in 2004. Research interests: highly competent computational physicist with extended knowledge of hydro-dynamics, optics and plasma physics. Expert in Numerical Simulation and Algorithm Development.

Dr. Kanat Dukenbayev – Academic Secretary at Nazarbayev University Research and Innovation system. He got PhD in physics from the Lausanne Area(Switzerland) in 2011. Research interests: Spectroscopy Biophysics, Scanning Probe Microscopy, Microfluidics, Optics Numerical Analysis.

Other participants from NURIS: Dr. Alexander Alexeev, Dr. Galymzhan Koishiev, Rustem Bolat, Assel Ryspaeva, Alexey Volkov, Aizhan Sabitova.

Non-NU participants

Dr. Maxim Zdorovets – Director of Heavy Ion accelerator in Astana and head of engineering laboratory of L.N. Gumilyov Eurasian National University. He is responsible to set up research activities at DC-60 and establish instruments in the wide range of fields including material science, nuclear physics, nanothechnology and creation new advanced materials. He got Ph.D. in 2010 from Eurasian National University, working in irradiated LiF crystals. His personal recent research focuses in fabrication, characterization and applications of track membrane.

Dr. Kireev Alexander - is a head of accelerator complex at Institute of Nuclear Physics in Almaty. He got BSc in engineering physics at S. Amanzhanov East-Kazakhstan State University. His current activities include development of AMS method, technical support of accelerator: ion beam, vacuum system, controlling automation system.

Professor Skakov Mazhim - Deputy Director General for Science of National Nuclear Center (NNC).

Sadykov Anuar - head of IT support group at TOKAMAK of Institute of Atomic Energy. He received BS in engineering from Shakarym Semipalatinsk state University in 2008.

Dr. Sayabek K. Sakhiyev - Professor of L.N. Gumilyov Eurasian National University. He received his B.S. and M.S. in physics in 1992 from Al-Farabi Kazakh National University. He got Doctor of Science in 2008 from Al-Farabi Kazakh National University in theoretical physics. He is specialists in theoretical plasma physics.