

The 17th CRYOGENICS 2023 IIR Conference & Exhibition

April 25 - 28, 2023 / Dresden, Germany

Tuesday – April 25, 2023

09:00 – 13:00 / *Exhibition Installation*

12:30 / *Registration Starts*

13:00 – 14:00 / *Welcome Get-together Snack*

14:00 – 14:20 / **Opening Ceremony**

Václav CHRZ - Conference Chairman, Past President of the IIR Commission A2
Ziad MELHEM - Chairman of the International Advisory Committee
Didier COULOMB - Director of the IIR
Ralf HERZOG - Conference Vice-Chairman, President of the IIR Section A

14:20 – 14:40 / **Invited Lecture**

Future Prospects of Cryogenics Applications in the Second Decade of the 21st Century

Ziad MELHEM

Oxford Quantum Solutions Ltd, Oxford, UK

14:40 – 15:40 / **Cryogenics in Particle Physics**

Chairs: Ralf HERZOG, Aleš SRNKA

14:40 – 15:00

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Lessons from Commissioning and Operations of the ICARUS Cryogenic System at Fermilab

Michael GEYNISMAN (a), Johan BREMER (b), Michel CHALIFOUR (b), Roza DOUBNIK (a), Caroline FABRE (b), Claudio MONTANARI(a,c), Trevor NICHOLS (a), Frederick SCHWARTZ (a), Peter WILSON (a), Michael ZUCKERBROT (a)

(a) Fermi National Accelerator Laboratory, Batavia, United States (b) CERN, Geneva, Switzerland (c) Istituto Nazionale di Fisica Nucleare (INFN), Pavia, Italy

15:00 – 15:20

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CERN Neutrino Platform Cryogenics, DUNE and ProtoDUNE

Johan BREMER (a), Michel CHALIFOUR (a), Joaquim CREUS PRATS (b), Caroline FABRE (a), Francesco LANNI (a), David MONTANARI (b), Marzio NESSI (a), Marco PEZZETTI (a), Francesco PIETROPAOLO (a), Filippo RESNATI (a)

(a) CERN, Geneva, Switzerland, (b) Fermi National Accelerator Laboratory, Batavia, United States

15:20 – 15:40

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Cryogenic Accelerator System for Direct Electron Therapy

Emma SNIVELY, Christopher NANTISTA, Zenghai LI, Valery BORZENETS, Marco ORIUNNO, Gordon BOWDEN, Anatoliy KRASNYYKH, Muhammad SHUMAIL, Sami G. TANTAWI

SLAC National Accelerator Laboratory, Menlo Park, U.S.A.

15:40 – 16:05 / *Coffee Break*

16:05 – 17:35 / Cryogenics in Particle Physics, Cryogenics for Fusion, Superconductivity

Chairs: Aleš SRNKA, Vojtěch KOHUT

16:05 – 16:25

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Cryogenics for HL-LHC, from cooling requirements to procurement and future challenges

Serge CLAUDET

CERN, Geneva, Switzerland

16:25 – 16:45

144

Challenges for the Cryogenics of the UK Spherical Tokamak for Energy Production (STEP programme)

John TEAH, Steven WRAY

UKAEA, Culham Science Centre, Abingdon, UK

16:45 – 17:05

110

Recuperative 4-Quadrant power supply tested with accelerator Magnet

Norbert GUST, Felix DONAT, Ulrich ZERWECK, Andreas KADE

ILK Dresden, Dresden, Germany

17:05 – 17:25

101

Efficiency Calculations for a Superconducting Transformer – An Experimental Investigation

Sean ORCHUK, Sanjeev CHANDRA

Department of Mechanical & Industrial Engineering, The University of Toronto, Canada

17:25 – 17:35 / Short Break

17:35 – 18:15 / Very Low Temperatures

Chairs: Ziad MELHEM, Jiří FROLEC

17:35 – 17:55

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Influence of the Geometric Arrangement of Continuous Heat Exchanger in the Condensation-driven Dilution Refrigerator

Hongye ZU(a,b), WeiJun CHENG (a,b), YaNan WANG (a), Wei DAI (a,b)

(a) Key Laboratory of Cryogenic Engineering, Technical Institute of Physical and Chemistry, CAS Beijing, China,

(b) University of Chinese Academy of Sciences, Beijing, China

17:55 – 18:15

159

High Field Dependence of the Magnetocaloric Effect in Low Temperature Ordered Laves-phase Pseudo-binary Compounds

Jacek ĆWIK(a), Yurii KOSHKID'KO(a), Karolina KOWALSKA(a), Bruno WEISE(b), Konstantin NENKOV(b), Nilson Antunes DE OLIVEIRA(c)

(a) Institute of Low Temperature and Structure Research, PAS, Wrocław, Poland, (b) Leibniz IFW Dresden, Institute for Complex Materials, Dresden, Germany, (c) Instituto de Física Armando Dias Tavares–Universidade do Estado do Rio de Janeiro, Rio de Janeiro, Brazil

08:30 / Registration Starts

09:00 – 10:20 / Thermal Insulation, Materials at Low Temperatures

Chairs: Dimitri DELIKARIS, Andreas KADE

09:00 - 09:20

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Transient Pool Boiling Heat Transfer of Cryogenic Liquid on Insulated Steel

Le-Duy NGUYEN, Myungbae KIM, Yongshik HAN, Kyuhyung DO

Korea Institute of Machinery and Materials, Daejeon, Republic of Korea

09:20 – 09:40

142

Impact of contamination of a metallic surface on its thermal absorptivity

Jiří FROLEC, Tomáš KRÁLÍK, Vojtěch KRUTIL

Institute of Scientific Instruments of the Czech Academy of Sciences, Brno, Czech Republic

09:40 – 10:00

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Experimental Methods Dedicated to the Study of Cracking Process in Laminated Composites Subjected to Thermomechanical Loadings

Yann ACCETTURA(a,b), Jean VEREECKE(a,c), Tanguy BRIAND(b), Christophe BOIS (a), Jean-Christophe WAHL(a)

(a) Université de Bordeaux, CNRS, I2M Bordeaux, Talence, France, (b) CMP Composites, Eysines, France

(c) Direction des Lanceurs, Centre National d'Études Spatiales (CNES) Paris, France

10:00 – 10:30 / Coffee Break

10:30 – 12:10 / Materials at Low Temperatures, Cryocoolers

Chairs: Andreas KADE, Jiří FROLEC

10:30 – 10:50

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Magnetic and Magnetocaloric Properties of $\text{Ho}_2\text{FeMnO}_6$ Nanopowder

Kiran SHINDE, Cheolhong HWANG, Joon Sik PARK

Department of Materials Science and Engineering, Hanbat National University, Daejeon, South Korea

10:50 – 11:10

154 – CANCELLED PARTICIPATION

Fatigue Strength Properties of SS304 at Cryogenic Temperatures

Chandan MAHISHI, Kashif AKBER, D.S.NADIG

Centre for Cryogenic Technology, Indian Institute of Science, Bengaluru, India

11:10 – 11:30

130

Numerical Research on Effects of Gravitational Settling and Thermophoresis of Mist Particles on Frost Formation under Cryogenic Conditions.

Akihiro HATTORI(a), Akihiro UEDA(a), Mikio YOSHIDA(a), Riku HIRAI(b), Tetsuya SATO(b)

(a) Graduate School of Fundamental Science and Engineering, Waseda University, Tokyo, Japan

(b) School of Fundamental Science and Engineering, Waseda University, Tokyo, Japan

11:30 – 11:50

113

A Cryogenic Test Setup for Characterization of Ultrasonic Flow Measurement

Tom WINKLER(a), Kay BODENDORFER(a), Martin KLUPSCH(a), Steffen RACKOW(a), Andreas KADE(a), Sebastian FRIEDRICH(b), Robert WESER(b), Andreas EHRlich(b)

(a) Institut für Luft- und Kältetechnik (ILK) gemeinnützige Gesellschaft mbH, Dresden, Germany,

(b) SICK Engineering GmbH, Ottendorf-Okrilla, Germany

11:50 – 12:10

138

Low Vibration cryocooler-based System for X-ray and Microscope Applications

Valery BORZENETS

SLAC National Accelerator Laboratory, Menlo Park, U.S.A.

12:10 – 13:45 / Lunch

13:45 – 15:25 / Liquid Helium, CO₂ Sequestration, Liquefaction of Natural Gas (LNG)

Chairs: Václav CHRZ, Gregor TROMMLER

13:45 – 14:05

153

Analytical Review of Studies on Assessing the Layout Impact and Kinematic Design of Microcryocooler on its Lifetime and MTTF

Natalia SHISHOVA, Ivan ARKHAROV, Ekaterina NAVASARDYAN, Viacheslav CHEKHOVICH, Semion TOKAREV (Presenting person: Yuri SEMENOV/Semion TOKAREV)

Bauman Moscow State Technical University, Moscow, Russia

14:05 – 14:25

148

Development and Characterization of a Centrifugal Pump for Low-loss Liquid Helium Transfer

Johannes DOLL(a), Steffen KLÖPPEL(a,b), Christoph HABERSTROH(a)

(a) TU Dresden, Institute of Power Engineering, Bitzer Chair of Refrigeration, Cryogenics and Compressor Technology, Dresden, Germany

(b) now at German Aerospace Center (DLR), Institute of Low-Carbon Industrial Processes, Zittau, Germany

14:25– 14:45

150

Low-pressure Liquefied CO₂ – A Model Study of the Loading of a CO₂ Tanker

Stian TRÆDAL, M. MONTAÑÉS RUBEN, Ingrid SNUSTAD, David BERSTAD

SINTEF Energy Research, Trondheim, Norway

14:45 – 15:05

105

Crystallization Risk of Aromatic Compounds in LNG Production. Part I: The Solubility of Benzene in Methane-Rich Mixtures Down to Cryogenic Temperatures

Marco CAMPESTRINI, Salem HOCEINI, Paolo STRINGARI

Mines Paris, PSL University, Centre for Thermodynamics of Processes (CTP), Fontainebleau, France

15:05 – 15:25

COMMERCIAL PRESENTATION

Biogas (SNG) Liquefaction with Air Refrigeration

Thomas FRANK, Paul WEERTS

Refolution Industriekälte GmbH, Karlsruhe, Germany

15:25 – 15:55 / Coffee Break

15:55 – 17:15 / Cryogenic Fuels, Liquid Hydrogen

Chairs: Christoph HABERSTROH, David AŠČIĆ

15:55 – 16:15

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Parameters Optimization of LCNG Filling Station Using Modelling and Simulation

Michal MICHNA, Mikoláš KRÁL, Václav CHRZ

Chart Ferox – Chart Industries, Děčín, Czech Republic

16:15 – 16:35

120

Techno-economic Analysis of Cold Energy Recovery in L-CNG Stations

Alice MUGNINI(a), Francesco ZITO(a), Mosè ROSSI(a), Gabriele COMODI(a), Alessia ARTECONI(a, b)

(a) Marche Polytechnic University Ancona, Italy, (b) Katholieke Universiteit Leuven, Belgium

16:35 – 16:55

146

Dynamic Analysis of Large-scale Transfer Operations for Liquid Hydrogen

Adriana REYES-LÚA, David BERSTAD, Stian TRÆDAL

SINTEF Energy Research. Department of Gas Technology, Trondheim, Norway

16:55 – 17:15

COMMERCIAL PRESENTATION

Liquid Hydrogen Technology

Sven CHUDZINSKI

Chart Industries, Inc., Monheim am Rhein, Germany

17:15 – 18:15 / Poster Session

You can find the list of poster presentations below at the end of the programme.

19:00 – 21:30 / Conference Dinner Party

08:30 / Registration Starts

09:00 – 10:20 / Liquid Hydrogen, Storage and Distribution of Cryogenic Gases

Chairs: Martin LÁNSKÝ, Martin KROUPA

09:00 – 09:20

132

Hydrogen Re-liquefaction Process for Boil-off Gas Handling on a Large-scale Liquid Hydrogen Carrier

Donghoi KIM(a), Stian TRÆDAL(a), David BERSTAD(a), Petter NEKSÅ(a), Kevin K. Yum(b)

(a) SINTEF Energy Research, Trondheim, Norway, (b) SINTEF Ocean, Trondheim, Norway

09:20 – 09:40

149

Hydrogen Permeability Testing of Fibre Reinforced Thermoplastics under Cryogenic Conditions – a Test Rig Concept

Thomas JUST, Julian WILL, Christoph HABERSTROH

Dresden University of Technology, Bitzer-Chair of Refrigeration, Cryogenics and Compressor Technology, Dresden, Germany

09:40 – 10:00

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Cryogenic H₂-Cooling System for Refueling Vehicles

Herzog FRIEDHELM, Gockel FRANK, Altindal SINAN

Messer SE & Co. KGaA, Krefeld, Germany

10:00 – 10:20

121

Novel Thermodynamic Model for Cryo-Compressed-Hydrogen Tanks

Johannes HAMACHER, Alexander STARY, Laura STOPS, Daniel SIEBE, Sebastian REHFELDT, Harald KLEIN

Technical University of Munich, Garching, Germany

10:20 – 10:45 / Coffee Break

10:45 – 12:25 / Cryobiology, Cryotherapy

Chairs: René KRETSCHMER, Pavel MĚŘIČKA

10:45 – 11:05

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Qualitative and Quantitative Changes in the Use of Cryo-technology during the 70-year History of the Tissue Bank, University Hospital Hradec Kralove

Pavel MERICKA, Jiri GREGOR, Miroslava JANDOVA

Tissue Bank University Hospital Hradec Kralove, Hradec Kralove, Czech Republic

11:05 – 11:25

141

Vitrification of Biological Materials by Slush Nitrogen

Alisson SILVA(a), Jacqueline COPETTI(a), Ionatan SCHRÖER(a), William SOUZA(a), Matheus CHANAN(a), Massoxi CUIÊCA(a), Mario MACAGNAN(a), Jeferson OLIVEIRA(b), Elaine CARDOSO(c), Karolyn OGLIARI(d)

(a) Mechanical Engineering Graduate Program, University of Vale do Rio dos Sinos-Unisinos, São Leopoldo, , Brazil, (b) Department of Mechanical Engineering, FSG - University Center of Serra Gaúcha, Caxias do Sul, Brazil, (c) UNESP - São Paulo State University, São João da Boa Vista, Brazil, (d) HemoCord - Umbilical Cord Blood Bank, Unisinos Technology Park- Tecnosinos/UNITEC, São Leopoldo, Brazil

11:25 – 11:45

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CAR-T Therapy, the New and Growing Application of Cryotechnology in Medicine

Jiří GREGOR(a), Pavel MĚŘIČKA(a), Miroslava JANDOVÁ(a), Miriam LÁNSKÁ(b), Jakub RADOCHA(b), David BELADA(b)

(a) Tissue Bank University Hospital Hradec Králové, Hradec Králové, Czech Republic

(b) 4th Department of Internal Medicine – Haematology University Hospital Hradec Králové, Czech Republic

11:45 – 12:05

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Ultratight Cryovials – Steps to Improve Sample Integrity

Ronald MIKSCHÉ, René KRETSCHMER, Florian KRESS, Andreas KADE

Institut für Luft- und Kältetechnik gemeinnützige Gesellschaft mbH, Dresden, Germany

12:05 – 12:25

116 (TBC)

Cryconservation of Plants in Ukraine

Emma ARAPETYAN

Ivan Franko National University, Lviv, Ukraine

12:25 – 13:45 / Lunch

13:45 – 14:45 / Cryotherapy, Rare Gases

Chairs: Jiří GREGOR, Vojtěch KOHUT

13:45 – 14:05

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Homogenic Cryotherapy for Heat Camera Diagnostic

Thomas FRANK

Refolution Industriekälte GmbH, Karlsruhe, Germany

14:05 – 14:25

133

Cryogenic High-Pressure Thermomechanical Pressurizer.

Iurii SYMONENKO(b), Artem CHYHRIN(a), Yevhen KOSTENKO(b)

(a) Cryoin Engineering Ltd, Odesa, Ukraine, (b) Odesa National University of Technology, Odesa, Ukraine

14:25 – 14:45

134

Separation of Binary Mixtures Based on Helium and Heavy Inert Gases.

Andrey BONDARENKO(a), Lurii SYMONENKO(b), Artem CHYHRIN(a), Petar DALAKOV(a)

(a) Cryoin Engineering Ltd, Odesa, Ukraine, (b) Odesa National University of Technology, Odesa, Ukraine

14:45 – 14:50 / Short Break

14:50 – 15:05 / Closing Ceremony

Václav CHRZ - Conference Chairman, Past President of the IIR Commission A2

Ziad MELHEM - Chairman of the International Advisory Committee

Ralf HERZOG - Conference Vice-Chairman, President of the IIR Section A

15:05 – 15:30 / Good-bye Coffee

15:00 – 18:00 / Exhibition Dismantling

Friday – April 28, 2023

09:00 – 12:00 / Technical Excursion to ILK Dresden

Poster Presentations

Wednesday - April 26, 2023 / 17:15 – 18:15

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The Linde Cycle Enhancement with a Mixed Refrigerant to Operate within -130 C to -150 C of Working Temperature Range

Andrii MOSTYTYSKYI, Oleg BAKLAN, Maxim LITVINENKO, Oleksandr PEKARYK, Sergiy KOKUL

Limited Liability Company "Research and Production Company "DNIPRO – MTO", Kyiv, Ukraine,

107

Rapid Cooling, Freezing and Steel Hardening Using Air Refrigeration

Thomas FRANK

Reolution Industriekälte GmbH, Karlsruhe, Germany

109

A Novel Lightweight Cryogenic Valve with Minimized Heat Transfer

Martin KLUPSCH(a), Joachim RÖDIGER(b), Marius MANEA(b), Fabrice NDEFFEU(b)

(a) Institut für Luft- und Kältetechnik gemeinnützige Gesellschaft mbH, Dresden, Germany,

(b) Stöhr Armaturen GmbH & Co KG, Königsbrunn, Germany

111

Cryocooler Development

Gunar SCHROEDER, Andreas KADE

Institut für Luft- und Kältetechnik gemeinnützige Gesellschaft mbH, Dresden, Germany

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Equipment for High Precision Controlled Rate Freezing of Microplates in Convection Freezers

Holger REINSCH, René KRETSCHMER

Institut für Luft- und Kältetechnik gemeinnützige Gesellschaft mbH, Dresden, Germany

119

Control-oriented Applications of Cryogenic & RF Coupled Simulations Based on a MATLAB/Simscape Cryomodule Model

Cédric LHOMME(a,b), Patxi DUTHIL(a), Tomas JUNQUERA(b), Frédéric BOULY(c), Hervé SAUGNAC(a), Matthieu PIERENS(a), Guillaume MAVILLA(a)

(a) IJClab, Orsay, France, (b) ACS, Orsay, France, (c) LPSC, Grenoble, France

128

Experimental Determination of the Relieving Capacity of the Pressure Relief Device Prototype (PDR) for Vacuum Jackets of Cryogenic Equipment

Jaroslav POLINSKI, Patryk SLAWINSKI - SLAWECKI

Wroclaw University of Science and Technology, Wroclaw, Poland

151

Analysis of Heat Inleaks in the Cryogenic Process with Using the Turbomachines

Vojtěch KOHUT(a), Luboš POLÁK(b)

(a) Freelance Consultant, Brno, Czech Republic, (b) Freelance Consultant, Oslavice, Czech Republic

158

Cryogenic Tests Results of the Regular Superconducting Magnets of the NICA Collider

Alena A. KOTOVA, D.N. NIKIFOROV, H.G. KHODZHIBAGIYAN H.G., Egbert FISHER

Joint Institute for Nuclear Research of Russia, Dubna, Russia,

160

RUBHY Project

Eszter DUDÁS, Charles RIGOUDY

CT INGENIERIE, Colomiers, France

163 – CANCELLED PARTICIPATION

Combining High-pressure and Low Temperature with Single Crystal Resonant X-ray Diffraction, P09, PETRA III

Christian PLUECKTHUN (a), Jennifer A. SEARS (a), Maximilian KUSCH (b), Pablo J. BERECIARTUA (a), Konstantin GLAZYRIN (a), Rahn MAREIN (b), Jochen GECK (b), Sonia FRANCOUAL(a)

(a) Deutsches Elektronen-Synchrotron (DESY) Hamburg, Germany (b) Technische Universität Dresden, Dresden, Germany

164

Overview and thermal characteristics of a near-infrared cross-dispersed spectrograph based on the arrayed waveguide grating technology

Eloy HERNANDEZ(a), Alan GÜNTHER(a), Andreas STOLL(a), Svend-Marian BAUER(a), Stella VJESNICA(a), Kalaga MADHAV(a), Martin M. ROTH(a,b)

(a) Leibniz-Institute for Astrophysics Potsdam, Potsdam, Germany,
(b) Institut für Physik und Astronomie, Universität Potsdam, Germany