ICC21 Preliminary Program

Tuesday, June 16, 2020

8:15 - 10:00 AM Aerospace Cryocoolers I

Thermal Design of the Earth Surface Mineral Dust Source Investigation (EMIT)
J.S. Cha, D.L. Johnson, and L.D. Fonseca. Jet Propulsion Laboratory, Pasadena, CA; O. Deng, D.G. Gilmore, The Aerospace Corp., El Segundo, CA

Enabling Ambitious Space Science Missions Thanks to 10K-20K Cryocooling
S. Carpentier, P.Barbier and J. Butterworth, Air Liquide Adv. Tech., Sassenage, France; S. Martin, I. Charles, J.M. Duval, Univ. Grenoble Alpes, Grenoble, France; F. Fontani, W.Errico, Sitael S.P.A., Pisa , Italy; J. Mullié , G. de Jonge, Thales Cryogenics, Eindhoven, The Netherlands, M. Branco, M. Linder, ESA-ESTEC, Noordwijk, The Netherlands

Integration of a Tactical Cryocooler for 6U Hyperspectral Thermal Imager
C.S. Kirkconnell, West Coast Solutions, CA; M.A. Nunes, Hawaii Space Flight Laboratory, HI; I. Ruehlich, AIM Infrarot-Module, Germany; H R. Papinsack, American Infrared Solutions; M.V. Zagarola, Creare, Hanover, NH; S.B. Rafol, JPL, Pasadena, CA

Characterization Testing of Space-Flight Lockheed Martin Micro1-2 Cryocooler for the Mapping Imaging Spectrometer for Europa (MISE)
I.M. McKinley, D.L. Johnson, J.I. Rodriguez, Jet Propulsion Laboratory, Pasadena, CA

LPT6510 Test Results up to TRL6
E. Jansen, R. Arts, J. Mullié, Thales Cryogenics B.V., The Netherlands; J. Tanchon, T. Trollier, Absolut System SAS, France

Qualification of Northrop Grumman MiniCoolerPlus Thermal Mechanical Unit for a Space-Flight Mission
L. Amouzegar, M. Petach, and L. Abelson, Northrop Grumman AS, Redondo Beach, CA

Performance Comparison of Active Cryocoolers and Passive Radiative Coolers for Space Applications
W. Chen, Jet Propulsion Laboratory, California Inst. of Tech., Pasadena, CA

10:15 - 11:45 AM Cryocooler Components I

Effect of Aftercooler Configuration on the Performance of Pulse Tube Cryocoolers
Y. Yasukawa, Fuji Electric Co., Tokyo, Japan; and Y. Ueda, Tokyo Univ. of Agriculture and Tech., Tokyo, Japan

Moving Iron Based Pressure Wave Generators: Preparing Air Liquide's New Generation Pulse Tube Cryocoolers
G. Coleiro, P. Barbier, J-M Niot, T. Wiertz, Air Liquide Adv. Tech., Sassenage, France; G. Aigouy, K. Benoit, F. Claeyssen, CEDRAT Tech., Meylan, France; and C. Daniel, CNES, Toulouse, France

Design of Oil-Free, Resonating Linear Compressors for Five-Stage Cascade System with New Refrigerants
A. Vidhate , B. T. Kuzhiveli, Centre for Adv. Studies in Cryogenics (CASC), Nat'l Inst. of Tech., Calicut, India

Performance Investigation of 3D Printed Regenerator for Pulse Tube Cryocooler Working at Liquid Nitrogen Temperature Region
C.G. Yan, W. Dai and X.T. Wang, Tech. Inst. of Physics and Chem., CAS, Beijing, China; Y.B. Zhang, M.T. Ma and H.B. Li, Lihan Cryogenics Co., Shenzhen, China

Effects of Structural Asymmetry on Regenerator Temperature Non-Uniformity in a High-Power Stirling-Type Pulse Tube Cryocooler
T. Wei, X. Tao, X. Zhi, X. You, J. Wang, L. Qiu, Inst. of Refrig. and Cryogenics, Zhejiang Univ., Hangzhou, China

Theoretical and Experimental Investigations on the HoCu2 and GOS as Regenerative Materials at 4-20K
R. Cao, X. Zhi, C. Huang and L. Qiu, Inst. of Refrig. and Cryogenics, Zhejiang University, Hangzhou, China

1:15 - 2:30 PM Very Low Temperature I: 4K and Below

Magnet Hysteresis Loss in Adiabatic Demagnetization Refrigerators
P. Shirron, M. Kimball, R. Ottens, J.Tuttle, and A. Jahromi, NASA/Goddard Space Flight Center, Greenbelt, MD

Performance Testing of a 2K Joule-Thomson Closed-Cycle Cryocooler
M. Crook, M. Hills, G. Gilley, T. Rawlings, C. Pulker, B. Green, STFC Rutherford Appleton Laboratory, Harwell, UK

Study for Continuity of Cooling Operation of SPICA Cryogenic System by Adding Refrigerant Circulation System
K. Narasaki, Sumitomo Heavy Industries, Ltd., Japan

Performance Analysis of Pulse Tube/3He Joule-Thomson Cryocooler for Thermometer Calibration
T. Shimazaki, NMIJ, AIST, Tsukuba, Japan

Adiabatic Expansion of ^{3}He in Superfluid He
A.T.A.M. de Waele, Eindhoven Univ. of Tech., Eindhoven, The Netherlands

2:30 - 3:45 PM Advanced Analysis and Modeling

Thermodynamic Process and Optimization of Dilution Refrigerator
M. Zheng, J. Liang, P. Lin , L. Wei and M. Zhao , Chinese Acadamy of Science, Beijing, China

Application of Signal Analysis in the Study of Dynamic Characteristics of Displacer in Cryocoolers
Z. Wang, Y.D. Lu, C.L. Yin, Y. Gao, The Provincial Key Laboratory of Cryogenic Technology, Hefei, China

Boundary Layer Losses in a Miniaturized Tapered Pulse Tube
A. Ghavami, S.M. Ghiaasiaan, Georgia Tech, Atlanta, GA; C. Kirkconnell, West Coast Solutions, Huntington Beach, CA

2:30 - 3:45 PM Brayton, J-T, and Sorption Cryocoolers II

Development of Neon Reverse-Brayton Cryogenic System Using Scroll Compressor Package
J. Ko, H. Yeom, H. Kim, J. Park, Y. Hong, S. In and S. Park, Korea Inst. of Mach. & Mat'ls, Daejeon, Korea

Development of Thin-Plate Square-Shape Sorption Compressor for 5 K J-T Cooler
J. Bae, D. Kwon, S. Jeong, Korea Adv. Inst. of Science and Tech. (KAIST), Daejeon, Korea

Study of Ejectors Impact on J-T Refrigeration Cycles Working below Liquid Helium Temperature
X. Wang, C. Yan, W. Dai, E. Luo, Key Laboratory of Cryogenics, Chinese Academy of Sciences, Beijing, China; and H. Li, Lihan Cryogenics, Shenzhen, China

Development of a Capillary Tube Orifice for Expansion Device of Joule-Thomson Cryocooler
J. Kim, H. Lim, S. Han, Korea Aerospace Research Inst., Korea

3:45 - 5:00 PM Displacers / Phase Shifters

Design and Analysis of a Passive Displacer for a Stirling Pulse Tube Cryocooler
H. Rana, M.A. Abolghasemi, R. Stone, M. Dadd, P. Bailey, Dept. of Engin. Science, Univ. of Oxford, UK

External Phase Shifting Tuning Mechanism in a Miniature Pulse Tube Cryocooler Using a Semi-Active Electromagnetic Damping System
Y. Greenberg, G. Grossman, Technion – Israel Inst. of Tech., Israel

An Exploration about a Micro-Cryocooler with Warm-Displacer Phase Shifter
Z.M. Guo, Tongji Univ., Shanghai, China and Univ.of Wisconsin-Madison, WI, USA; J.M. Pfotenhauer, Univ. of Wisconsin-Madison, WI, USA; S.W. Zhu, Tongji Univ., Shanghai, China

Optimization of Phase Controller for Pulse Tube Cryocooler
D. Abraham and B.T Kuzhiveli, Centre for Adv. Studies in Cryogenics (CASC), Nat'l Inst. of Tech., Calicut, India

Investigation of Energy Conversion Processes in High Length-to-Diameter Ratio Coiled Resonant Tubes Driven by Periodic Mass Injection Conditions in Thermo-acoustic Expansion Device
Z. Hu, Cryowave Adv. Tech., RI, USA

Wednesday, June 17, 2020

8:00 - 9:00 AM Cryocooler Integration Tech

Ball Low-Vibration Cryocooler Assemblies (CCAs)
D. Glaister, R. Taylor, and C. Gorham, Ball Aerospace, Boulder, CO

High Performance Thermal Straps for a Full Range of Application Temperatures
M. Ralphs, M. Sinfield, and M. Felt, Space Dynamics Lab, Logan, UT

Space Cryogenic Circulator
D. Frank, J.R. Olson, V. Mistry, E. Roth, A.D. Ruiz, Lockheed Martin ATC, Palo Alto, CA

Cryocooler with Novel Circulator Providing Broad Area Cooling at 90K for Spaceflight Applications
M. Petach, L. Amouzegar, Northrop Grumman AS, Redondo Beach, CA

9:00 - 10:15 AM Aerospace Cryocoolers II

Flight Model Cooling Performance of 4K-class Cooler for XRISM
K. Otsuka, S. Tsunematsu, K. Kanao, K. Narasaki, Sumitomo Heavy Ind., Japan; H. Sugita, K. Shinozaki, Y. Sato, R&D Directorate, JAXA, Japan

Development of 5W Class Pulse Tube Cooler for Space Use
Y. Hiratsuka, Tech. Research Center, Sumitomo Heavy Industries, Ltd., Yokosuka, Japan; K. Otsuka, K. Kanao and K. Narasaki, Indus. Equip. Div., Sumitomo Heavy Industries, Niihama, Japan

Air Liquide LPTC Operation Using Creare MCCE Electronics
M. Zagarola, R. Kaszeta, Ceare, Hanover, NH; G. Bodovillé, D. Lopes, R. Astier, T. Wiertz, Air Liquide Adv. Tech., Sassenage, France

9:00 - 10:15 AM Cryocooler Components II

Optimization of the Transition Regenerator for Two-Stage Thermal-Coupled Stirling-Type Pulse Tube Cryocooler
Q.L Zhu, Y.J Liu, J.Quan, J.T Liang, Key Laboratory of Space Energy Conv. Tech., Tech. Inst. of Physics and Chem., CAS, Beijing, China

Measurement of Thermal Conductivity of Some Candidate Regenerator Materials at Cryogenic Temperatures
A. Ghavami, S. M. Ghiaasiaan, Georgia Tech, Atlanta, GA; C. Kirkconnell, West Coast Solutions, Huntington Beach, CA

High Effectiveness Micro-Tube Recuperators for Low-Capacity Turbo-Brayton Cryocoolers for Space
A.L. Niblick, K.J. Cragin, M.V. Zagarola, Creare LLC, Hanover, NH

9:00 - 10:15 AM Very Low Temperature II: 4K and Below

Numerical Analysis for a Continuously Operating Adiabatic Demagnetization Refrigerator (ADR) between 4.2 K and 2.0 K
D. Kwon, J. Bae, S. Jeong Cryogenic Engin. Laboratory, Korea Adv. Inst. of Science and Tech., Daejeon, Korea

The Development of an Active Magnetic Regenerative Refrigerator (AMRR) for sub-Kelvin Cooling of Space Science Instrumentation
C.M. Gunderson, G.F. Nellis, F.K. Miller, Univ. of Wisconsin - Madison, Madison, WI

10:15 - 11:45 AM Cryocooler Modeling Tools

Development of Stirling Cryocooler Model that Includes a Full Simulation of the Appendix Gap
T. Rawlings, M. Crook, M. Hills, STFC Rutherford Appleton Laboratory, Harwell, UK

Development of a 2D/3D Computational Fluid Dynamic Code for Analyzing Regenerators
A. Ghavami, S.M. Ghiaasiaan, Georgia Tech, Atlanta, GA; C. Kirkconnell, West Coast Solutions, Huntington Beach, CA

CFD Simulation Of A Hybrid Cryocooler with Pulse Tube Precooling
S. Yang; W. Yang; C. Wang; D. Qin, Univ. of Chinese Academy of Sciences, Beijing, China

Numerical Analysis of Inertance Pulse Tube Cryocooler for Optimum Reservoir Volume using Property Variation for Working Fluid Helium
S. Kathare, C. Singhvee, R. Prasad KS, PES University, India

Design of High Capacity Pulse Tube Cooler with C-Type Flexure for High Temperature Super Conductor Applications
M. Sudheer, B.T. Kuzhiveli, Centre for Adv. Studies in Cryogenics (CASC), Nat'l Inst. of Tech., Calicut, India

Thermodynamic Analysis and Design of Miniature BLDCM Driven Crank Driven Cooler
K. Santhosh, B.T. Kuzhiveli, Centre for Adv. Studies in Cryogenics (CASC), Nat'l Inst. of Tech., Calicut, India

1:15 - 3:15 PM Brayton, J-T, and Sorption Cryocoolers I

Testing of a 10 K Turbo-Brayton Cryocooler for Spaceflight Applications
K.J. Cragin, M.V. Zagarola, J.A. McCormick, Creare LLC, Hanover, NH

Efficiency Improvements for Turbo-Brayton Cryocoolers for Space
M.V. Zagarola, K.J. Cragin, R.W. Hill, J.A. McCormick, Creare LLC, Hanover, NH

Experimental Validation of a Numerical Model for Nitrogen-Activated Carbon Sorption Compressor Cells
N. Tzabar, A. Davidesko and A. Hamersztein, Thermal Energy Science & Tech. Laboratory, Ariel Univ., Ariel, Israel

Design, Fabrication, and Testing of a 1 Watt at 22 Kelvin Joule-Thomson Cryogenic Refrigerator
W. Notardonato, Eta Space, Rockledge, FL; A. Swanger, NASA KSC, FL; J. Baik, Meta Vista USA, Orlando, FL; R. Roy, Skyre Inc., West Hartford, CT

Comparison of Experimental and Modeling Results for Mixture Optimization of a Mixed-Gas Joule-Thomson Cycle
J. Detlor, J. Pfotenhauer, and G. Nellis, Univ. of Wisconsin, Madison, WI

The Importance of Fluid Property Data for the Development of Cryogenic Mixed-Refrigerant Cycles
S. Grohmann, Karlsruhe Inst. of Tech., Inst. of Tech. Physics, Leopoldshafen, Germany; J. Tamson, Karlsruhe Inst. of Tech., Inst. of Tech. Thermodynamics and Refrigeration, Karlsruhe, Germany

A Neon JT Cooler for ARIEL
M. Hills, M. Crook, A. Eagles, G. Gilley, B. Green, S. Kendall, C. Padley, C. Pulker, T. Rawlings, STFC Rutherford Appleton Laboratory, Harwell, Oxford , UK

Numerical and Experimental Investigation of Miniature Cryocooler Constructed Using Low-Temperature Cofired Ceramic Technology
B. Baran, M. Chorowski, Z. Malecha, Z. Rogala, Dept. of Cryogenics and Aerospace Engin., WUST, Poland; and K. Malecha, W. Nawrot, Dept. of Microsystems, WUST, Poland

3:30 - 4:45 PM Stirling / Pulse Tube I

Exported Forces and Torques of Tactical Cryocoolers
I.M. McKinley, M.A. Mok, J.I. Rodriguez, JPL, Pasadena, CA

Characterization of RICOR K548 for UCIS-Airborne
M.A Mok, I.M McKinley, G.R Naness, M.D Makowski, NASA JPL, Pasadena, CA

Cost Effective Split and Integral Linear Stirling-Type Cryocoolers for HOT IR Imaging
A. Veprik, S. Zehctzer, A. Daniels, R. Refaeli and A.Wise, CryoTech Ltd, Israel

A kW-class Free-Piston Stirling Cooling Prototype for Ultra-Low Temperature Freezing
K.Q. Luo, Y.L. Sun, Z.J. Jiang, E.C. Luo, J.Y. Hu, L.M. Zhang, Z.H. Wu, Z.L. Jia, Y. Zhou, Chinese Academy of Sciences, Beijing, China

A 4 K Gas-Coupled Two-Stage High-Frequency Pulse Tube Cryocooler
X.M. Liu, L.B. Chen, J.J. Wang, Y. Zhou, Chinese Academy of Sciences, Beijing, China

Thursday, June 18, 2020

8:00 - 9:00 AM Cryocooler Electronics

Reduced-Size Cryocooler Electronics for Space
K.D Frohling, Iris Technology, Irvine, CA

Cryocooler Electronics for Spaceflight Micro Cryocooler
E.M. Livingstone-White, J.O. Goldsten, S.G. Fix, A.S. Ahmad, Johns Hopkins Univ. Applied Physics Laboratory, Laurel, MD.

Linear Cryocooler Electronics for Tactical Space Missions
B.R. Pilvelait, C.B. Cameron, R.W. Kaszeta, M.V. Zagarola, Creare LLC, Hanover, NH; and M. Martin, N. Hudson, C. Kirkconnell, West Coast Solutions, Huntington Beach, CA

Specifying Cryocooler Electronics for Space Based Missions
K.D Frohling, Iris Technology, Irvine, CA

9:00 - 10:15 AM Stirling and Pulse Tube Technologies

Research of a High Capacity Coaxial Pulse Tube Cryocooler Working at 170 K
L.J. Wei, N.L. Wang, M.G. Zhao, J.H. Cai, L.T. Liang, Technical Institute of Physics and Chemistry, CAS, Beijing China

The Study on High Efficiency and Low Vibration Flexure Bearing Stirling Cryocooler
C. L. Yin, Y. Gao, H. Yan, F. Wang, Q. Hong, X. H. Fan, Z. Wang, Inst. of Cryogenics and Electronics, Hefei, China

Study of the Effect of Gas Contamination in Stirling Cryocoolers
C. L. Yin, Y. Gao, K. Yang, Z .Wang, X. H. Fan, S .S .Chen, Inst. of Cryogenics and Electronics, Hefei, China

A Lightweight 7W/80K Pulse Tube Cryocooler
N. Wang, M. Zhao, H. Chen, J. Liang, J. Cai, Q. Zhu, M. Zheng, Tech. Inst. of Physics and Chemistry, CAS, China

Enhancement of Linear Compressor Power and Performance Improvement of Pulse Tube Refrigerator
B. Kim, J. Bae, S. Jeong, Korea Adv. Inst. of Science and Tech. (KAIST), Daejeon, Korea

Design and Performance Test of Miniature Linear Stirling Cryocoolers
X. Wang, W. Dai, E. Luo, Key Laboratory of Cryogenics of Chinese Academy of Sciences, China; and L. Yang, Y. Zhang, H. Li, Lihan Cryogenics, China

9:00 - 10:15 AM Cryocooler Integration Technologies II

Liquefaction of Natural Gas using a kW-Class Free-Piston Stirling Cryocooler (FPSC)
S. In, J. Ko, H. Kim, Y. Hong, H. Yeom, S. Park, Korea Inst. of Machinery and Mat'ls (KIMM), Daejeon, Korea

Closed Cycle Cryocoolers in Low Temperature Silicon Analysis
D. Dutta, Bhabha Atomic Research Centre, Dept. of Atomic Energy, India

The Modified Linde-Hampson Cycles with GM-JT Refrigeration for Small-Scale Hydrogen Liquefaction Processes
J. Park, S.W. Karng, Korea Inst. of Sci. and Tech., Seoul, Korea; H. Lim, G.W. Kim, G.H. Rhee, Univ. of Seoul, Seoul, Korea; S.Y. Kim, Hylium Industries, Seongnam, Korea

Cold Head Maintenance of GM Cryocoolers with Minimal Service Interruption
R. Verma, H.N. Nagendra, S. Kasthurirengan, N.C. Shivaprakash, U. Behera, Nat'l Inst. of Tech., Jalandhar, India

Experimental Study on Response of Split Stirling Cryocooler to Mechanical Conditions under Non-Rigid Contact Conditions
Z. Wang, J. Chen, C.L Yin, Y.D. Lu, Y. Gao, The Provincial Key Laboratory of Cryogenic Tech., Hefei, China

10:15 - 11:45 AM Advanced Analysis

Thales Rotary Cooler Performance Models Allowing Transient Thermal Analysis
C. Vasse, G. Raynal, V. Abousleiman, Thales LAS, France; T. Benschop, Thales Cryogenics, France

Detailed Analysis of a Coaxial Stirling Pulse Tube Cryocooler with an Active Displacer
M.A. Abolghasemi, H. Rana, R. Stone, M. Dadd, P. Bailey, Dept. of Engin. Science, Univ. of Oxford, Oxford, UK; K. Liang, Dept. of Engin. and Design, Univ. of Sussex, Brighton, UK

Numerical Study of Influence of Regenerator and Pulse Tube on a Cryogen-Free VM-Type Pulse Tube Cryocooler Performance
Y. Cui, W. Dai, Y. Wang, X. Wang, E. Luo, Key Laboratory of Cryogenics, Tech. Inst. of Physics and Chem., CAS, and Univ.of CAS, Beijing, China; and X. Long and J. Zhu, Lihan Cryogenics, Shenzhen, China

Ball Standard Cryogenic Uncertainty Margins
D. Glaister, C. Gorham, R. Franck, D. Green, Ball Aerospace, Boulder, CO

Evolution of Stratification and Self-Pressurization of Liquid Nitrogen for J-T Cryocooler under Elevated Gravity Condition
Vishnu S.B., B.T.Kuzhiveli, Centre for Adv. Studies in Cryogenics (CASC), Nat'l Inst. of Tech., Calicut, India

Effects of Real Fluid Properties on Cryocooler Regenerators
R. Snodgrass, V. Kotsubo, and S. Backhaus, National Institute of Standards and Technology, Boulder, CO

1:15 - 3:00 PM Cryocooler Applications

Space Exploration Applications for Development of High Capacity Reverse Turbo-Brayton Cycle Cryocoolers
B.T. Nugent, M.C. Guzik, and W.L. Johnson, NASA GRC, Cleveland OH; J.R. Stephens, NASA MSFC, Huntsville, AL

Configuration of Cryocoolers in Large Electric Power Systems for Superconducting Electrified Transportation Applications for Enhanced Resilience
S. Telikapalli, P. Cheetham, C.H. Kim, S. Pamidi, Florida State Univ., Tallahassee, FL

Cryocooler Technology for Electron Particle Accelerators
G. Lawler, N. Majernik, A. Fukasawa, J. Rosenzweig, UCLA, Los Angeles, CA

Storage Time and Venting Characteristics for Cryogenic Air Supplies after Turning Off Their Cryocoolers
L. Yan, R. Fernando, D.S. Yantek, J.L. Carr, M.A. Reyes, C.R. DeGennaro, J.A. Yonkey, J.R. Srednicki, CDC/NIOSH, Pittsburgh, PA

Cryocoolers in Breathing Air Cryogenic Storage and Supply Systems
R.D. Fernando, CDC-NIOSH, Pittsburgh, PA

A Small-Scale Hydrogen Liquefier Using Joule-Thomson Cryocoolers
H. Lim, G.W. Kim, G.H. Rhee, Univ. of Seoul, Seoul, Korea; S.H. Choi, Sungkyunkwan Univ., Suwon, Korea; J. Park, S.W. Karng, Korea Inst. of Science and Tech. Seoul, Korea

Development and Validation of a Small-Scale Hydrogen Liquefier Using a Modified Linde-Hampton Cycle
S.Y.Kim and J. Lee, Hylium Industries, Korea; S.W. Park, Korean Inst. of Science and Tech., Korea

3:15 - 4:30 PM Stirling / Pulse Tube II

AIM Cryocoolers for Harsh Environments
I. Rühlich, M. Mai, C. Rosenhagen, T. Wiedmann and S. Zehner, AIM Infrarot-Module, Germany

The Effect of Transfer Line Length, Operating Frequency and Heat Rejection Temperature Distribution on the Thales LPT Cryocoolers
I.M. McKinley, C.D. Hummel, J.I. Rodriguez, Jet Propulsion Laboratory, Pasadena, CA

High-Availability Stirling Coolers
D. Willems, T. Benschop, R. Arts, B. de Veer, and P. Bollens, Thales Cryogenics BV, Eindhoven, The Netherlands

Advances in a Resonance Tube-Coupled Duplex Stirling Cooler
G.Y. Yu, H.Y. Ma, Y. Ma, W. Dai and E.C. Luo, TIPC, CAS, China; X.W. Li, CSDDC, China

Reverse Application of a Coaxial Free Piston Stirling Engine for Space Applications
P.S. Adithian, B.T.Kuzhiveli, Centre for Adv. Studies in Cryogenics (CASC), Nat'l Inst. of Tech., Calicut, India