

Spray Combustion

Chairperson: C.F. Edwards

- 9:15 am *Fuel Effects on the Structure of a Forced Spray Flame*, Chris Wark and Cill Richards, Washington State University, Pullman, Washington, USA..... 3
- 9:45 am *Experimental and Numerical Study of Burning Air-assisted Atomizer Sprays Characteristics*, Dong Il Kim, and Sang Huen Oh, Pusan National University, Pusan, Korea..... 4
- 10:15 – 10:30 am **Break, Exhibits, and Posters**
- 10:30 am *Droplet Size Distribution and Residence Time Effects on a Lean Partially-Premixed Turbulent Spray Flame*, Y. Michou, C. Pichard, and I. Gökalp, Laboratoire de Combustion et Systèmes Réactifs, Centre National de la Recherche Scientifique, Orléans, France..... 4
- 11:00 am *Numerical Simulation of Spray-Flat Flames Stabilized in a Laminar Counterflow*, Fumiteru Akamatsu, Hiroyasu Saitoh, and Masashi Katsuki, Osaka University, Osaka, Japan..... 5
- 12:00 – 1:30 pm **Lunch Break, Exhibits, and Posters**

Atomization I

Chairpersons: G.M. Faeth and C.S. Lengsfeld

- 1:30 pm *Control of Drop Size by Rheology*, V. Romagnoli, P. Felton, and R. K. Prud'homme, Princeton University, Princeton, New Jersey, USA..... 6
- 2:00 pm *Influence of Exit Orifice Characteristics on Transition Between Effervescent Atomization Flow Regimes*, C.J. Bates and P.J. Bowen, Cardiff School of Engineering, Cardiff, Wales, UK, and J.C.F. Teixeira, University of Minho, Guimares, Portugal..... 6
- 2:30 pm *Influence of Superpulsating Mode on Atomization Properties in Coaxial Air-Assisted Atomizers*, B. Leroux and O. Delabroy, Air Liquide, Jouy en Josas, France, and F. Lacas, Ecole Centrale Paris, Chatenay-Malabry, France..... 7
- 3:00 pm *Spray Characteristics of Water/Oil Emulsified Fuel*, Jung-Hyun Rhim and Soo-Young No, Chungbuk National University, Cheongju, Korea, and Gyu-Young Lee and Ok-Yong Yang, Inha University, Incheon, Korea..... 8
- 3:30 – 4:00 pm **Break, Exhibits, and Posters**
- 4:00 pm **Invited Paper:** *Spray Breakup Mechanism from the Hole Type Nozzle and its Applications*, Hiro Hiroyasu, Kinki University, Hiroshima, Japan..... 8
- 4:30 pm *The Role of Viscoelasticity on Jet Breakup of Dilute Polymer Solutions*, Y. Christanti and L. M. Walker, Carnegie Mellon University, Pittsburgh, PA, USA..... 9
- 5:00 pm *Numerical Study of Breakup Processes of a Water Jet Injected into Cross Air Flow*, Fengshan Liu, Greg J. Smallwood, and Ömer L. Gülder, National Research Council Canada, Ottawa, Ontario, Canada..... 9

Jet and Sheet Instabilities I

Chairpersons: C. Dumouchel and J. Senda

- 9:15 am *Prediction of Liquid Sheet Breakup from Dual-Mode Linearized Theory*, Sushanta K. Mitra, Xian-guo Li, and Metin Renksizbulut, University of Waterloo, Waterloo, Ontario, Canada 10
- 9:45 am *Numerical Simulation of the Instability and the Breakup of a Viscous Liquid Jet*, Akira Sou, Hisashi Hasegawa, and Tsuyoshi Nakajima, Kobe University, Kobe, Japan 11
- 10:15 – 10:30 am **Break, Exhibits, and Posters**
- 10:30 am *Numerical Investigation of a Laminar Jet Breakup into Drops in Liquid-Liquid Systems*, S. Homma, J. Koga, and S. Matsumoto, Saitama University, Saitama, Japan, and G. Tryggvason, University of Michigan, Ann Arbor, Michigan, USA 12
- 11:00 am *Droplet Size Distribution of Sprays Produced by Newtonian Liquid Jets*, H. Malot, J.B. Blaisot and C. Dumouchel, Université et INSA de Rouen, Mont Saint Aignan, France 13
- 11:30 am *Velocity Profile Effect and Phase Intermittency in Low Velocity Cylindrical Liquid Jets*, J. Godelle, C. Letellier, and C. Dumouchel, Université et INSA de Rouen, Mont Saint Aignan, France..... 13
- 12:00 – 1:30 pm **Lunch Break, Exhibits, and Posters**

Spray Instrumentation and Measurements I

Chairpersons: G. Wigley and G. Gouesbet

- 1:30 pm **Invited Paper:** *Spray Diagnostics for the Twenty-first Century*, W.D. Bachalo, Artium Technologies, Inc., Los Altos Hills, California, USA 14
- 2:00 pm *High Speed Laser-PIV Imaging System for the Eulerian-Lagrangian Measurement and Visualization of Spray on Wall-Bounded Jets*, T. Sarpkaya, Naval Postgraduate School, Monterey, California, USA, and C. F. Merrill, Naval Surface Weapons Center, West Bethesda, Maryland, USA 14
- 2:30 pm *1D Spontaneous Raman Scattering for Comprehensive 2D Spray Characterization*, T. Müller and V. Beushausen, Laser-Laboratorium Goettingen e.V., Goettingen, Germany, and W. Hentschel, Volkswagen AG, Wolfsburg, Germany 15
- 3:00 pm *Evaluation of the Planar Droplet Sizing (PDS) Technique*, R. Domann and Y. Hardalupas, Imperial College of Science, Technology, and Medicine, London, UK 16
- 3:30 – 4:00 pm **Break, Exhibits, and Posters**
- 4:00 pm *A New Strategy to Measure Temperature of Droplets: Two Colors Laser-Induced Fluorescence Comparison to Infrared Thermometry*, P. Lavieille, F. Lemoine, and M. Lebouché, LEMTA, Vandœuvre-les-Nancy, France, and O. Ravel, G. Lavergne, J.Farré, ONERA/DMAE, Toulouse, France 17
- 4:30 pm *Experimental Investigation on the Measurement of Drop Size Distribution of Sprays Produced by High Pressure Swirl Atomizers*, S. Boyaval and C. Dumouchel, Université et INSA de Rouen, Mont-Saint-Aignan, France 18
- 5:00 pm *Conversion of Droplet Size Distributions from PMS Optical Array Probe to Malvern Laser Diffraction*, M. E. Teske, Continuum Dynamics, Inc., H. W. Thistle, USDA Forest Service, A. J. Hewitt, Stewart Agricultural Research Services, and I. W. Kirk, USDA Agricultural Research Service, USA 19

Industrial Sprays I*Chairpersons:* J. Domnick and S. Londerville

- 9:15 am *Droplet Formation in a High-Enthalpy Steam Jet*, J. McFarlane and M. Hogeveen Ungurian, Containment Analysis Branch, Atomic Energy of Canada Limited, Pinawa, Canada..... 20
- 9:45 am *Performance of a Linear Internal Mixing Atomizer in Atomization of Molten Metals*, M.R. Wang, M.S. Sheu, and S.R. Yang, National Cheng Kung University, Tainan, Taiwan 20
- 10:15 – 10:30 am **Break, Exhibits, and Posters**
- 10:30 am *Heat Transfer Performance And Power Requirements Of Pressure Swirl Nozzles*, O. Schmidt and J.S. Lewis, Middlesex University, London, United Kingdom, and J Kubie, Napier University, Edinburgh, United Kingdom..... 21
- 11:00 am *Numerical Analysis of Solidifying Molten Salt Droplets in An Exhaust Duct*, X. M. Wang, H. Hi-yama, and H. Hashimoto, Ebara Research Co., Ltd., Honfujisawa, Fujisawa-shi, Japan 21
- 11:30 am *Atomization Pressure Reduction as the Way of Fuel Staging*, R. Wilk and A. Szlek, Silesian University of Technology, Gliwice, Poland 22
- 12:00 – 1:30 pm **Lunch Break, Exhibits, and Posters**

Spray Deposition*Chairperson:* M. Orme

- 1:30 pm *Mono-Disperse Aluminum Droplet Generation and Deposition for Net-Form Manufacturing of Structural Components*, Melissa Orme and Qingbin Liu, University of California, Irvine, CA, USA, and John Fischer, Boeing Commercial Airplane Group, Seattle, Washington, USA..... 23
- 2:00 pm *Particulate Air Pollution and Health*, R.F. Phalen, University of California, Irvine, California, USA 23
- 2:30 pm *Characterization of the Deposition Process of Spray Forming in Linear Atomizer*, P. A. Pérez, J.E. González, and R. Sánchez, University of Puerto Rico, Mayagüez, Puerto Rico..... 24
- 3:00 pm *Modelling of Deposit Shape During Metal Spraying: the Influence of Splashing and Re-Deposition*, Z. Djuric and P. Grant, University of Oxford, Oxford, UK 25
- 3:30 – 4:00 pm **Break, Exhibits, and Posters**
- 4:00 pm *Electrostatic Generation of Ultra Fine Spray of Ceramic Suspensions for Deposition of Ceramic Thin Films*, P. Miao, W. Balachandran, and P. Xiao, Brunel University, Middlesex, UK 26
- 4:30 pm *On Factors Influencing the Wetting Angle Behavior after a Molten Microdroplet Impacts a Surface*, D. Attinger, Z. Zhao, and D. Poulikakos, Swiss Federal Institute of Technology (ETH), Zürich, Switzerland 27
- 5:00 pm *Dispersion and Deposition of Inhalation Therapy Sprays in the Larynx and Trachea Using Experimental and Numerical Methods*, T. Gemci, T. E. Corcoran and N. Chigier, Carnegie Mellon University, Pittsburgh, Pennsylvania, USA..... 28

Particle and Spray Dynamics I

Chairpersons: H. Fujimoto and Y. Tambour

- 9:15 am *Structures of Aerated Liquid Fuel Jets Interacting with a Shock Train in Supersonic Crossflows*, K.-C. Lin, P. J. Kennedy, Taitech, Inc., and T. A. Jackson, Air Force Research Laboratory, Wright-Patterson AFB, Ohio, USA..... 28
- 9:45 am *The Effect of Droplets on Turbulence Modulation and Air Entrainment in an Axisymmetric Spray Jet*, V. Ferrand, R. Bazile, J. Borée and G. Charnay, Institut de Mécanique des Fluides de Toulouse, Toulouse, France..... 29
- 10:15 – 10:30 am **Break, Exhibits, and Posters**
- 10:30 am **Invited Paper:** *Towards a Comprehensive Theory of Dense Spray Flows*, Chris Edwards, Stanford University, Stanford, California, USA..... 29
- 11:00 am *An Evaluation of a Current Model for Collisions and Coalescence in Diesel Sprays in Light of Recent Experimental Findings*, Scott Post and John Abraham, Purdue University, West Lafayette, Indiana, USA 30
- 11:30 am *Experimental Study on the Interaction of Fine Water Spray with Liquid Pool Fires*, Liao, Guangxuan, Liu, Jianghong, Wang, Xishi, Qin, Jun, and Yao, Bin, State Key Laboratory of Fire Science, University of Science and Technology of China, Hefei, Anhui, P.R.China 31
- 12:00 – 1:30 pm **Lunch Break, Exhibits, and Posters**

Internal Flows in Atomizers I

Chairpersons: D. Dunn-Rankin and P. Sojka

- 1:30 pm *Formation and Primary Breakup of Conical Liquid Sheets Discharged by Pressure Swirl Injectors. Experimental and Theoretical Investigation*, J. Cousin, Université et INSA de Rouen, Saint Etienne du Rouvray, France, and G. Vich and J.F. Nally Jr, Siemens Automotive, Newport News, Virginia, USA..... 31
- 2:00 pm *Enhanced Atomization of a Liquid Jet by Cavitation in a Nozzle Hole*, N. Tamaki, M. Shimizu and H. Hiroyasu, Kinki University, Hiroshima, Japan..... 32
- 2:30 pm *Investigation of Internal Flow in Transparent Diesel Injection Nozzles using Fluorescent Particle Image Velocimetry (FPIV)*, J. Walther, J. K. Schaller, and R. Wirth, Robert Bosch GmbH, Stuttgart, Germany, and C. Tropea, Universität Darmstadt, Germany 33
- 3:00 pm *Effect of Internal Flow in a Simulated Diesel Injection Nozzle on Spray Atomization*, H. Iida, K. Tanaka, J. Senda, and H. Fujimoto, Doshisha University, Japan, E. Matsumura, Toyota Motor Co., Japan, and R.R. Maly, Daimler Chrysler AG, Germany 34
- 3:30 – 4:00 pm **Break, Exhibits, and Posters**
- 4:00 pm *Cavitating Flow in Diesel Injectors and Atomization: a Bibliographical Review*, N. Dumont, C. Habchi, Institut Français du Pétrole, Rueil-Malmaison, France, and O. Simonin, Institut de Mécanique des Fluides de Toulouse, Toulouse, France 35
- 4:30 pm *Numerical Simulations of Internal Flow in a Simplex Atomizer*, E. Steinthorsson, Parker Hannifin Corporation, Mentor, Ohio, and D. M. Lee, Fluent Inc., Lebanon, New Hampshire, USA..... 36

Agricultural Sprays

Chairpersons: A. Hewitt and S.-Y. No

- 8:00 am *Emulsion Properties and Agricultural Spray Quality*, R.W. Dexter, American Cyanamid Company, Princeton, New Jersey, USA 37
- 8:30 am *Evaluation of the Effects of Adjuvants on Agricultural Spray Characteristics*, A.J. Hewitt, Stewart Agricultural Research Services, Inc., USA, P.C.H. Miller, Silsoe Research Institute, England, and W.E. Bagley, Wilbur-Ellis Company, USA 37
- 9:00 am *Using Pulsed Sprays from Oversized Orifices to Increase Momentum and Kinetic Energy in Depositing Agricultural Sprays*, D.K. Giles, University of California, Davis, California, USA, and P.G. Andersen and M. Nilars, Hardi International A/S, Taastrup, Denmark 38
- 9:30 am *A Multiple EHDA Nozzle System for the Spraying and Selective Deposition of Pesticides in Greenhouses*, K.B. Geerse, J.C.M. Marijnissen, and B. Scarlett, Delft University of Technology, Delft, The Netherlands, and A. Keressies, M. van der Staaij, and C.A. van der Meer, Research Station for Floriculture and Glasshouse Vegetables (PBG), Naaldwijk, The Netherlands 38
- 10:00 – 10:30 am **Break, Exhibits, and Posters**
- 10:30 am *Measurements of the Air Pattern and the Vertical Spray Distribution as Tools for the Adjustment of Orchard Sprayers*, A. De Moor, J. Langenakens, E. Vereecke, Ministry of Small Enterprises, Traders and Agriculture, and P. Jaeken, Royal Research Station of Gorsem, Belgium 39
- 11:00 am *Droplet Size Analysis of Aircraft Nozzle Systems Applying Oil and Water Based Formulations of Endosulfan Insecticide*, N. Woods, G. Dorr, and I. P. Craig, The University of Queensland, Gatton, Queensland, Australia 40
- 11:30 am *In-Flight Measurements of Droplet Sizes from Agricultural Nozzles, a Comparison of Two Commonly Used Laser Systems*, M.S. Nilars, and P. Spragge, Hardi International, Denmark, and C. Tuck, Silsoe Research Institute, England 41
- 12:00 – 1:30 pm **Lunch Break, Exhibits, and Posters**

Industrial Sprays II

Chairperson: G.S. Samuelsen

- 1:30 pm *Characteristics of NH₃ and SO₂ Gas Absorption in Clean Water Spray Chamber*, M. Inoue, H. Gomi and A. Takahashi, Takasago Thermal Engineering, Atsugi, Japan, and H. Aoki and T. Miura, Tohoku University, Sendai, Japan 41
- 2:00 pm *Steady State High Pressure Spray Cooling of High Temperature Steel Surfaces*, R.A. Sharief, A.J. Yule, I.R. Widger, J.R. Jeong, D.D. James, University of Manchester Institute of Science and Technology, Manchester, England, and G.G. Nasr, Stockport College of Technology, England... 42
- 2:30 pm *Formation of Hollow Silica Particles by Electrostatic Atomization in Combination with Alcohol Solidification*, Masayuki Sato, Masashi Awazu, Shinya Aoki, and Takayuki Ohshima, Gunma University, Gunma, Japan 43
- 3:00 pm *Advances in the Study of Liquid Metal Atomization and Powder Formation*, K. P. Cooper, Naval Research Laboratory, Washington, DC, USA, S. J. Mashl, Bodycote IMT, Inc., Andover, Massachusetts, USA, and C. I. Whitman, Industrial Problem Solving, Southport, Connecticut, USA..... 43
- 3:30 – 4:00 pm **Break, Exhibits, and Posters**
- 4:00 pm *A Study of the Twin Fluid Atomization of Liquid Metals*, Steven P. Mates and Gary S. Settles, Penn State University, University Park, Pennsylvania, USA 44
- 4:30 pm *Spray Characterization for Wet Compression Gas Cooling Applications*, Rudolf J. Schick and Keith Knasiak, Spraying Systems Co, Wheaton, Illinois, USA 44

Diesel Sprays I

Chairperson: M. Arai

- 8:00 am **Invited Paper:** *Views on the Structure of Transient Diesel Sprays*, Greg J. Smallwood and Ömer L. Gülder, National Research Council Canada, Ottawa, Ontario, Canada 45
- 8:30 am *Effects of Micro-Hole Nozzle and High - Pressure Fuel Injection Characteristics on Combustion and Emissions*, Jinha Lee and Norimasa Iida, University of Keio, Kanagawa, Japan 46
- 9:00 am *Quantitative Visualization of Vapor Phase in High Pressure Common Rail Diesel Injection*, G. Bruneaux, Institut Français du Pétrole, Rueil-Malmaison, France 47
- 9:30 am *A Non-Equilibrium Turbulence Dissipation Correction for the $k-\epsilon$ Model Applied to Combustion Simulations of DI Diesel Engines*, Franz X. Tanner, Michigan Technological University, Houghton, Michigan, USA, and Guang-Sheng Zhu and Rolf D. Reitz, University of Wisconsin, Madison, Wisconsin, USA 47
- 10:00 – 10:30 am **Break, Exhibits, and Posters**
- 10:30 am *Characteristics of Atomization by Heating of Subcooled Injecting Liquid near the Entrance of Nozzle Hole*, T. Oda, T. Suzuki, and Y. Ochiai, Tottori University, Tottori, Japan 48
- 11:00 am *A Study of Spray Characteristics in a High Pressure Vessel and a Visualization Engine*, Y. Nishijima, Y. Asaumi, and Y. Aoyagi, New A.C.E. institute Co., Ltd., Karima, Tsukuba-shi, Ibaraki, Japan 49
- 12:00 – 1:30 pm **Lunch Break, Exhibits, and Posters**

SI Engine Sprays I

Chairperson: R. Ragucci

- 1:30 pm **Invited Paper:** *Experiments and CFD of Gasoline Direct Injection and Diesel Sprays*, Thierry Baritaud, Institut Français du Pétrole, Rueil-Malmaison, France 49
- 2:00 pm *A New Approach for Linking Experimental Data to Spray Modeling for an Outwardly Opening Direct Injection Gasoline (DI-G) Injector*, S. Das, D. L. S. Hung, L. E. Markle and P. G. Van-Brocklin, Delphi Energy and Engine Management Systems, Rochester, New York, USA 50
- 2:30 pm *Droplet Velocity and Size Fields in the Near Nozzle Region of a Dual Fluid Gasoline Direct Injector*, G. Wigley, Loughborough University, Leicestershire, UK, and J. Heath and G. Pitcher, Lotus Engineering, Hethel, Norwich, UK 50
- 3:00 pm *Physical Mechanisms Involved in Fuel Atomization from Intake Valve and Port Surfaces*, K. R. Koederitz, M.R. Evers, and J. A. Drallmeier, University of Missouri, Rolla, Missouri, USA 51
- 3:30 – 4:00 pm **Break, Exhibits, and Posters**
- 4:00 pm *Spray Simulation for Low Pressure Port Fuel Injectors*, Ansgar Christ and Jörg Schlerfer, Robert Bosch GmbH, Stuttgart, Germany 51
- 4:30 pm *Spray Cone Angles of Port Fuel Injectors by Different Measuring Techniques*, Jei- Ho Kim, Byung-Soo Moon, Jung-Hyun Rhim, and Soo-Young No, Chungbuk Nat'l University, Cheongju, Korea, and Joo-Young Kim and Seung-Kook Baik, KEFICO, Kyungki-Do, Korea 52
- 5:00 pm *Effect of Pressure Modulation on Micro-Machined Port Fuel Injector Performance*, Muhammed Hamid, Hoisan Kim, Kyoung-Su Im, and Ming-Chia Lai, Wayne State University, Detroit, Michigan, USA, Hans-Joachim Nuglisch, Siemens Automotive, Newport News, Virginia, USA, and John Dressler, Fluid Jet Associates, Spring Valley, Ohio, USA 52

Physics of Atomization Processes

Chairpersons: C. Mehring and C.S. Lengsfeld

8:00 am	<i>Prediction of Gas- or Liquid- Like Jet Injection Behavior in Practical Combustion Systems Based on Initial Surface Tension Values.</i> C.S. Lengsfeld, University of Denver, Denver, Colorado, and J.-P. Delplanque, Colorado School of Mines, Golden, Colorado, USA.....	54
8:30 am	<i>Can Atomization Be Improved by Viscosity Increase?</i> Yuriy Khavkin, University of Minnesota, Minneapolis, Minnesota, USA	54
9:00 am	<i>Development of a Compressible Liquid Impact Model of Fan Atomization.</i> Quy Duc Bui, Delavan Spray Technologies, Monroe, North Carolina, USA.....	55
9:30 am	<i>Interferometric Measurements of the Thickness Distribution of a Liquid Sheet Formed by Two Impinging Jets.</i> Yeon-Jun Choo and Bo-Seon Kang, Chonnam National University, Kwangju, Korea	56
10:00 – 10:30 am	Break, Exhibits, and Posters	
10:30 am	<i>Swirl Atomizer Atomization Quality: A New Concept.</i> Yuriy Khavkin, University of Minnesota, Minneapolis, Minnesota, USA	57
11:00 am	<i>Characterization of Free Surface Structures on High-Speed Liquid Jets.</i> T. Sarpkaya, Naval Postgraduate School, Monterey, California, USA.....	57
11:30 am	<i>Molecular Dynamics Simulation of Primary Atomization.</i> Michael M. Micci and S.K. Oechsle, The Pennsylvania State University, University Park, Pennsylvania, USA, and W.O. Mayer, DLR Lampoldshausen, Germany	58
12:00 – 1:30 pm	Lunch Break, Exhibits, and Posters	

Spray/Wall Interactions I

Chairpersons: G. Smallwood and M.-C. Lai

1:30 pm	<i>Liquid Film Atomization Due to Sharp Edge: Separation Criterion and Droplets Characteristics Model.</i> D. Llory, J.-F. Le Coz, C. Habchi, Institut Français du Pétrole, Rueil-Malmaison, France, and F. Maroteaux, Université Paris VI LMP, St Cyr l'ecole, France	58
2:00 pm	<i>Secondary Atomization from Diesel Fuel Spray Impingement.</i> S.P. Mislevy and P.V. Farrell, University of Wisconsin, Madison, Wisconsin, USA	59
2:30 pm	<i>Modeling of Spray-Wall Interactions Considering Liquid Film Formation.</i> S.H. Lee and H.S. Ryou, ChungAng University, Seoul, Korea	59
3:00 pm	<i>Droplets Splash Related with a Wall Impingement of Liquid Jet.</i> Young-II Kim and Masataka Arai, Gunma University, Kiryu, Japan	60
3:30 – 4:00 pm	Break, Exhibits, and Posters	
4:00 pm	Invited Paper: <i>Modeling of Spray Impact on Solid Surfaces.</i> C. Tropea and I. V. Roisman, Technische Universität Darmstadt, Darmstadt, Germany	61
4:30 pm	<i>Spray-Wall Interaction Model Considering Superheating Degree of the Wall Surface.</i> Koichi Ashida and Tomohiro Takahashi, Toyota Motor Co., Aichi, Japan, and Tomoyuki Tanaka, Jung-Kuk Yeom, Jiro Senda, and Hajime Fujimoto, Department of Mechanical Engineering, Doshisha University, Kyotanabe, Kyoto, Japan.....	62
5:00 pm	<i>Computations of the Liquid-Phase Penetration in Vaporizing Diesel Sprays using a Two-Fluid Model: Equilibrium and Non-Equilibrium Effects.</i> V.A. Iyer and J. Abraham, Purdue University, West Lafayette, Indiana, USA, and V. Magi, University of Basilicata, Italy.....	63

Electrostatic Sprays I

Chairpersons: T. McCracken and W. Balachandran

- 8:00 am *Simulation of the Electrostatic Spray Painting Process with High-Speed Rotary Bell Atomizers*, J. Domnick, A. Scheibe, T. Steigleder, G. Weckerle, and Q. Ye, Fraunhofer-Institut for Manufacturing Engineering and Automation, Stuttgart, Germany 64
- 8:30 am *Space Charge Transport in Dielectric Fluid Flows*, J. S. Shrimpton, Imperial College of Science, Technology and Medicine, London, UK 65
- 9:00 am *Numerical Simulation of Spray Transport in Electrostatic Rotary Bell Applicators*, Kyong-Su Im, Zeng-Chan Zhang, Sheng-Tao Yu, and Ming-Chia Lai, Wayne State University, Detroit, Michigan, USA, and William Meredith, Dupont Inc., Troy, Michigan, USA 65
- 9:30 am *Characteristics of Unsteady Charged Sprays*, J. S. Shrimpton, Imperial College of Science, Technology and Medicine, London, UK 66
- 10:00 – 10:30 am **Break, Exhibits, and Posters**

Spray Modeling I

Chairpersons: H. Fujimoto

- 10:30 am **Invited Paper:** *Perspectives on Large Eddy Simulations for Sprays: Issues and Solutions*, Josette Bellan, Jet Propulsion Laboratory, Pasadena, California, USA 66
- 11:00 am *The Stochastic Sub-Grid-Scale Model of Atomization in the Liquid Sprays Computation*, M. Gorokhovski, CNRS/University of Rouen, Mont-Saint-Aignan, France 67
- 11:30 am *A Vaporization Model Problem to Validate Statistical Models of Sprays*, S. Subramaniam, Rutgers, The State University of New Jersey, Piscataway, New Jersey, USA 67
- 12:00 – 1:30 pm **Lunch Break, Exhibits, and Posters**

Spray Instrumentation and Measurements II

Chairperson: W. Bachalo

- 1:30 pm *The Study of Effects of the Refractive Index n_g on a Phase Doppler Particle Analyzer*, Jy-Cheng Chang, Chi-Sheng Chu, and Chi-Yu Chen, Chung Cheng Inst. of Technology, Taiwan 68
- 2:00 pm *Numerical Investigation of the Effects of a Skinner on the Structure of Dense Sprays*, Fengshan Liu, Greg J. Smallwood, and Ömer L. Gülder, National Research Council Canada, Ottawa, Ontario, Canada 69
- 2:30 pm *Simultaneous Experimental Observation of Droplet Size and Droplet Velocity of Fuel Injection Sprays*, B. B. Ineichen, M. Stoeckli and C. Aubert, Swiss Federal Institute of Technology ETH, Switzerland 69
- 3:00 pm *Splicing Together Size Distributions to Increase the Size Range of a Phase Doppler Interferometer*, J. F. Widmann, S. R. Charagundla, C. Presser, and S. D. Leigh, National Institute of Standards and Technology, Gaithersburg, Maryland, USA 70
- 3:30 – 4:00 pm **Break, Exhibits, and Posters**
- 4:00 pm *Development of a Quantitative Measurement of a Diesel Spray Core Using Synchrotron X-rays*, R. Poola, C. F. Powell, Y. Yue, S. Gupta, A. McPherson, and J. Wang, Argonne National Laboratory, Argonne, Illinois, USA 70
- 4:30 pm *Measurement of Temperature on In-Flight Droplets by Laser Induced Fluorescence*, S. Escobar and J.E. González, University of Puerto Rico, Mayagüez, Puerto Rico 71
- 5:00 pm *High-Speed Ultrasonic Flowmeter for Combustion Stability Studies*, B. K. Loudin, P. B. Nagy, S. M. Jeng, and C.W. Fox, University of Cincinnati, Cincinnati, Ohio, USA 72

Electrostatic Sprays II

Chairpersons: G. Lavergne and A. Yule

8:00 am	<i>Electrohydrodynamic Single Droplet Generator for Conductive Fluids</i> , S.Q. Armster and E.J. Lavernia, University of California, Irvine, California, USA.....	72
8:30 am	<i>Numerical Modeling of Inductively Charged Sprays</i> , M. R. Jahannama, A.P. Watkins and A. J. Yule, UMIST, Manchester, UK.....	73
9:00 am	<i>Application of Electrostatically Charged Sprays in Gasoline Direct Injection Engines Using Plain Orifice Atomizers</i> , G.C.S. Nhumaio and A.P. Watkins, University of Manchester Institute of Science and Technology, Manchester, UK, and J.S. Shrimpton, Imperial College, London, UK.....	74
9:30 am	<i>Spray Behavior under the Effect of Superimposed Electrostatic Charge</i> , H. Abdel-Hameed and H. El-Salmawy, Zagazig University, and H.ElGhazaly and M.M.Elkotb, Cairo University, Egypt.....	75
10:00 – 10:30 am	Break, Exhibits, and Posters	

Atomizers I

Chairpersons: A. Lefebvre and M. Benjamin

10:30 am	Invited Paper: <i>The Emergence of Smart Sprays</i> , Scott Samuelsen, University of California, Irvine, California, USA.....	75
11:00 am	<i>Development of Micro-Diesel Injector Nozzles via MEMS Technology and Effects on Spray Characteristics</i> , S.Baik, S.Kang, J.Blanchard, and M.Corradini, Engine Research Center, University of Wisconsin, Madison, Wisconsin, USA.....	76
11:30 am	<i>Fluidic Sprays</i> , S. Raghu, Bowles Fluidics Corporation, Columbia, Maryland, USA, and K. Kiger and U. Kumar, University of Maryland, College Park, Maryland, USA.....	77
12:00 – 1:30 pm	Lunch Break, Exhibits, and Posters	

Droplets and Sprays at High Ambient Pressures

Chairpersons: I. Gökalp and J. Bellan

1:30 pm	<i>Effect of the Ambient Pressure on a Steady Flow Discharged from a High Pressure Swirl Injector</i> , E. Topenot, Le Moteur Moderne, Palaiseau, France, and J.-L. Carreau, Laboratoire de Combustion et Détonique, Futuroscope Chasseneuil, France.....	78
2:00 pm	<i>Spray/Gas Behavior of Cryogenic Fluids under Sub- and Supercritical Conditions</i> , B. Chehroudi, ERC, Inc., and R. Cohn, and D. Talley, Air Force Research Laboratory, Edwards AFB, California, USA	79
2:30 pm	<i>Soret and Dufour Effects on the Production of Turbulent Scales in a Temporal Supercritical n-Heptane/Nitrogen Three-Dimensional Mixing Layer</i> , N. Okong'o and J. Bellan, Jet Propulsion Laboratory, Pasadena, California, USA.....	80
3:00 pm	<i>Spray Characteristics of Impinging Jet Injectors at High Back-Pressure</i> , P. A. Strakey and D. G. Talley, Air Force Research Laboratory, Edwards AFB, California, USA.....	81
3:30 – 4:00 pm	Break, Exhibits, and Posters	
4:00 pm	<i>Experimental Study on Evaporation Behavior of a Hydrocarbon Droplet in Sub- and Supercritical Atmospheres</i> , H. Nomura and Y. Ujiie, Nihon University, Chiba, Japan, J. Sato, Ishikawajima-Harima Heavy Industry Co., Ltd., Tokyo, Japan, H. J. Rath, University of Bremen, Bremen, Germany, and M. Kono, University of Tokyo, Tokyo, Japan.....	82
4:30 pm	<i>The D^2 Variation for Drops in Polydisperse Clusters at Supercritical Conditions</i> , K. Harstad and J. Bellan, Jet Propulsion Laboratory, Pasadena, California, USA.....	83
5:00 pm	<i>Vaporization of n-Alkane Droplets at High Temperature and Pressure</i> , C. Morin, C. Chauveau and I. Gökalp, Laboratoire de Combustion et Systèmes Réactifs, Centre National de la Recherche Scientifique, Orléans, France.....	83

Spray Modeling II

Chairpersons: R. Reitz and Ö. Gülder

- 8:00 am *A Computational Tool for Spray Modeling using Lagrangian Droplet Tracking in a Homogeneous Flow Model*, T.L. Pham and S.D. Heister, Purdue University, West Lafayette, Indiana, USA 84
- 8:30 am *A Two-Fluid Spectral Element Method with Application to Drops*, B. T. Helenbrook and C. F. Edwards, Stanford University, Stanford, California, USA 84
- 9:00 am *Derivation of Eulerian Type Conservation Equations for Atomization Processes*, Kenji Amagai and Masataka Arai, Gunma University, Gunma, Japan 85
- 9:30 am *Modelling Polydisperse Sprays without Discretisation into Droplet Size Classes*, J. C. Beck and A. P. Watkins, University of Manchester Institute of Science and Technology, Manchester, UK 86
- 10:00 – 10:30 am **Break, Exhibits, and Posters**

Droplet and Breakup Phenomena I

Chairpersons: G. Brenn and F. Ruiz

- 10:30 am *Hydrodynamic and Thermodynamic Characterization of In-Flight Droplets Generated by Thermal Ink Jet Print-Heads*, M.E. Parrado and J.E. González, University of Puerto Rico, Puerto Rico 87
- 11:00 am *A Holographic Study of Cylindrical Droplet Deformation and Breakup due to Shock Wave Loading Including Unsteady Drag Coefficient Approximations*, D. Igra, T. Ogawa and K. Takayama, Tohoku University, Sendai, Japan 88
- 11:30 am *Secondary Droplet Breakup Due to Time Varying Aerodynamic Loads*, Bradford Bruno and Domenic Santaviceca, Penn State University, University Park, Pennsylvania, USA 89
- 12:00 – 1:30 pm **Lunch Break, Exhibits, and Posters**
- 1:30 pm **Invited Paper:** *Improving Droplet Breakup and Vaporization Models by Including High Pressure and Turbulence Effects*, I. Gökalp, C. Chauveau, C. Morin, B. Vieille, M. Birouk, Centre National de la Recherche Scientifique, Orléans, France 89
- 2:00 pm *Numerical Simulation of Coalescence and Separation Behavior during Binary Droplets Collision*, Yoshio Morozumi, Mototsugu Nakamoto, Jun Fukai, and Osamu Miyatake, Kyushu University, Fukuoka, Japan 90

Spray Instrumentation and Measurements III

Chairperson: C. Presser

- 2:30 pm *A Method for Extending PIV to Determine Particle Size and 3-D Velocity*, J.A. Friedman, Ryerson Polytechnic University, Toronto, Ontario, Canada, and M. Renksizbulut, University of Waterloo, Waterloo, Ontario, Canada 90
- 3:00 pm *Stereoscopic Particle Image Velocimetry Evaluation in a Spray*, Virginia Palero, Kei Sato, Yuji Ikeda and Tsuyoshi Nakajima, Kobe University, Japan, and Joseph Shakal, TSI Inc., USA 91
- 3:30 – 4:00 pm **Break, Exhibits, and Posters**
- 4:00 pm **Invited Paper:** *Generalized Lorenz-Mie Theories - Past to Future*, G. Gouesbet and G. Gréhan, Université et INSA de Rouen, Mont Saint Aignan, France 91
- 4:30 pm *Visualization of an Airblast-Atomized Spray Jet using Laser Induced Fluorescence and Scattering Methods*, M.Y. Leong, V.G. McDonell, and G.S. Samuelsen, University of California, USA 92
- 5:00 pm *An Experimental Investigation of Combustion of Dissimilar Fuels by Moiré Deflectometry*, D.K. Sharma and S. Stephen, Indian Institute of Technology, T. Nadu, India 92

Gas Turbine and Rocket Sprays

Chairpersons: P. Strakey

- 8:00 am **Invited Paper:** *Fuel Atomization for Next Generation Gas Turbine Combustors*, M.A. Benjamin, Parker Hannifin Corporation, Mentor, Ohio USA..... 93
- 8:30 am *CFD Analysis of Fuel Atomization, Spray Dispersion and Evaporation in the Premix Duct of a LPP Combustor*, Roland Schmehl, Georg Maier, and Sigmar Wittig, University of Karlsruhe, Karlsruhe, Germany 93
- 9:00 am *A Multipoint Fuel Injection Strategy for Dry Low NO_x Combustion*, Adel Mansour and Michael Benjamin, Parker Hannifin Corporation, Mento, Ohio, USA, and Douglas L. Straub and Geo A. Richards, U.S. Department of Energy, Morgantown, West Virginia, USA 94
- 9:30 am *Lean Premixed Prevaporized System Without and With Swirl Experimental and Numerical Study*, V. Quintilla, SNECMA, Site de Villaroche, Moissy-Cramayel, France, and P. Trichet, O. Boïse-neau, G. Lavergne, and O. Prin, ONERA, Centre de Toulouse, Toulouse, France 94
- 10:00 – 10:30 am **Break, Exhibits, and Posters**
- 10:30 am *Plain Jet Kerosene Injection into High Temperature, High Pressure Crossflow With and Without Filmer Plate*, Julian Becker and Christoph Hassa, DLR - German Aerospace Center, Institute of Propulsion Technology, Linder Hohe, Cologne, Germany 95
- 11:00 am *A New Hybrid Air Blast Nozzle*, Adel Mansour and Michael Benjamin, Parker Hannifin Corporation, Mento, Ohio, USA 96
- 11:30 am *Atomization of a Liquid Jet in a Gas-Turbine Configuration*, R. Ragucci, Istituto di Ricerche sulla Combustione - C.N.R. - Napoli, and A. Cavaliere, R. D'Amico, Università Federico II, Italy 96
- 12:00 – 1:30 pm **Lunch Break, Exhibits, and Posters**
- 1:30 pm *Review of Atomization: Current Knowledge and Future Requirements for Propulsion Combustors*, M. A. Benjamin, Parker Hannifin Corporation, Mentor, Ohio, USA, and R. J. Jensen, The Boeing Company, Canoga Park, California, USA 97
- 2:00 pm *Evaporation of Polydisperse Sprays of Liquid Fuels and Liquid Oxidizers in a Shear Layer Flow*, D. Katoshevski, Ben-Gurion University of the Negev, Beer-Sheva, Israel, and Y. Tambour, Technion – Israel Institute of Technology, Haifa, Israel 97

Particle and Spray Dynamics II

Chairpersons: M. Archambault and Y. Khavkin

- 2:30 pm *A Study of the Sprays Produced by Fire Suppression Sprinkler Systems*, S. J. Walmsley and A. J. Yule, University of Manchester, Institute of Science and Technology, Manchester, U.K..... 98
- 3:00 pm *Computation of Spray Dynamics by Direct Solution of Moment Transport Equations - Inclusion of Nonlinear Momentum Exchange*, M. Archambault, Air Force Research Laboratory, and C.F. Edwards, Stanford University, USA 99
- 3:30 – 4:00 pm **Break, Exhibits, and Posters**
- 4:00 pm *Modeling of Cryogenic Spray Temperature and Evaporation Rate Based on Single-Droplet Analysis*, G. Aguilar, W. Verkruysse, B. Majaron, Y. Zhou, J.S. Nelson, and E.J. Lavernia, Department of Chemical and Biochemical Engineering and Materials Sciences, and Beckman Laser Institute and Medical Clinic, University of California, Irvine, California, USA..... 100
- 4:30 pm *Experimental Study of Evaporating Full-Cone Spray by Determining Droplet Temperature with Rainbow Refractometry and Comparing with Numerical Solution*, T. Gemci, J. Hom and N. Chigier, Carnegie-Mellon University, Pittsburg, Pennsylvania, USA 101
- 5:00 pm *Fundamental Investigation of the Disintegration of a Sinusoidally Forced Liquid Jet*, H. Chaves, F. Obermeier, T. Seidel and V. Weise, Technical University of Freiberg, Germany 102

Atomization II

Chairpersons: N. Ashgriz and S.-Y. No

8:00 am	<i>The Acceleration and Breakup Length of the Liquid Jet Quantified by a Visualization Method</i> , Tsai, R.F., Lin, S.Y., and Lee, G.Y., National Hu-wei Institute of Technology (NHIT), Yun-lin, Taiwan, and Whitelaw J.H., Imperial College of Science, Technology and Medicine, London, England. 103
8:30 am	<i>Atomization of a Heated Liquid Jet: Enhancement of Breakup and Dispersion through a Hole Nozzle</i> , Laurent Pouvreau, Eurocopter Deutschland GmbH, Munich, Germany, and Takuo Yoshizaki and Keiya Nishida, Hiroshima University, Hiroshima, Japan..... 103
9:00 am	<i>Pneumatic Nozzle for Small Size Scales</i> , Prof. Dr. techn. P. Walzel and Dipl.-Ing. P. Broll, University of Dortmund, Dortmund, Germany 104
9:30 am	<i>Numerical Simulation of Droplet Formation from Coaxial Twin-Fluid Atomizer</i> , Takao Inamura, Hirosaki University, Aomori, Japan, and Masatoshi Daikoku, Hachinohe Institute of Technology, Aomori, Japan..... 105
10:00 – 10:30 am	Break, Exhibits, and Posters
10:30 am	<i>The Influence of Viscoelastic Fluid Properties on the Formation of Fat Sprays</i> , M. Steier, G. Brenn, and F. Durst, University of Erlangen-Nürnberg, Erlangen, Germany, and A.L. Yarin, Technion - Israel Institute of Technology, Haifa, Israel..... 106
11:00 am	<i>Modeling of Atomization for Hollow-Cone Sprays under Flash Boiling Conditions</i> , Y. Zeng and C.F. Lee, University of Illinois at Urbana-Champaign, Urbana, Illinois, USA 107
11:30 am	<i>LDV Measurements of Drop Velocity in Flash Boiling Spray</i> , Qiao, Xinqi, Liu, Jianjiang, and Huang, Zhen, Shanghai Jiaotong University, Shanghai, P.R. China..... 108
12:00 – 1:30 pm	Lunch Break, Exhibits, and Posters

Jet and Sheet Instabilities II

Chairperson: S.Y. Lee

1:30 pm	<i>Comments on Energy Conservation in Liquid-Stream Disintegration</i> , William A. Sirignano and Carsten Mehring, University of California, Irvine, California, USA 109
2:00 pm	<i>A Theoretical Parametric Study of the Instability of a Viscous Annular Liquid Sheet</i> , Y. Liao, S. M. Jeng, and M. A. Jog, University of Cincinnati, Cincinnati, Ohio, USA, and M. A. Benjamin, Parker Hannifin Corporation, Mentor, Ohio, USA..... 109
2:30 pm	<i>Spatial Instability of a Liquid Jet in a Second Immiscible Liquid</i> , Anthony Bright, Harvey Mudd College, Claremont, California, USA..... 110
3:00 pm	<i>Determination of Local Properties of the Instabilities on a Capillary Jet</i> , J.B. Blaisot and S. Adeline, Université et INSA de Rouen, Mont-Saint-Aignan, France 110
3:30 – 4:00 pm	Break, Exhibits, and Posters
4:00 pm	<i>Planar-Liquid-Stream Distortion from Kelvin-Helmholtz and Capillary Effects</i> , Carsten Mehring and William A. Sirignano, University of California, Irvine, California, USA..... 111
4:30 pm	<i>Theoretical Study of Longitudinal Motion of Vertical Liquid Jet</i> , H. M. Chung, J. K. Seok, S.Y. Moon, and C. W. Lee, Kyungpook National University, Taegu, Korea 111
5:00 pm	<i>Experimental Study of a Thin Planar Liquid Sheet Disintegration</i> , P. Berthoumieu and H. Carentz, ONERA - DMAE, Toulouse, France..... 112

Spray/Wall Interactions II

Chairperson: H. Foucart

- 8:00 am *Droplet Impact on a Tube: Simulations and Experiments*, M. Pasandideh-Fard, M. Bussmann, S. Chandra, and J. Mostaghimi, University of Toronto, Toronto, Ontario, Canada 113
- 8:30 am *Numerical and Experimental Drop Impact on Solid Dry Surfaces*, W.I.Geldorp, R.Rioboo, S. Jakirlic, and C. Tropea, Technical University of Darmstadt, Darmstadt, Germany, and S. Muzaferija, Institute of Computational Continuum Mechanics GmbH, Hamburg, Germany..... 114
- 9:00 am *Multidimensional Modelling of Gasoline Spray Impingement and Liquid Film Heat Transfer and Boiling on Heated Surfaces*, C. Habchi and H. Foucart, Institut Francais du Pétrole, Rueil-Malmaison, France 115
- 9:30 am *Modeling Fuel Spray Impingement on a Flat Wall Surface*, Zhiyu Han, Zheng Xu and Nizar Trigui, Ford Motor Company, Dearborn, Michigan, USA..... 116
- 10:00 – 10:30 am **Break**

Internal Flows in Atomizers II

Chairpersons: R. Schick and C. Habchi

- 10:30 am *The Effect of Two-Phase Feed on Nozzle Performance for Low Gas-to-Liquid Ratios*, Z. M. Tafreshi, D. Kirpalani, A. Bennett and T. McCracken, National Research Council of Canada, Ottawa, Ontario, Canada 116
- 11:00 am *The Dynamics of a Swirling Liquid Film*, Chien-Pei Mao, Delavan Gas Turbine Products Division, BF Goodrich Aerospace, West Des Moines, Iowa 117
- 11:30 am *Experimental Study of the Transmission of Acoustic Waves to a Liquid Jet Emerging from a Reservoir*, Anthony Bright, Harvey Mudd College, Claremont, California, USA, and Melissa Orme, University of California, Irvine, California, USA 117
- 12:00 – 1:30 pm **Lunch Break**
- 1:30 pm *On the Influence of Internal Flow Structure on Performance of Plain-Orifice Atomizers*, C. Xu, R.A. Bunnell, S.D. Heister, and T. Pham, Purdue University, West Lafayette, Indiana, USA 118
- 2:00 pm *CFD Evaluation of the Effect of Internal Flow on Spray Characteristics of High Pressure Swirl Injectors*, Changsoo Jang and Sangmin Choi, Korea Advanced Institute of Science and Technology, Taejeon, South Korea 118
- 2:30 pm *Effervescent Diesel Injection: Injector Internal Flow and its Influence on Spray Quality*, Sandeep D. Sovani, Paul E. Sojka, and Jay P. Gore, Purdue University, West Lafayette, Indiana, USA, and John D. Crofts and Wayne A. Eckerle, Cummins Engine Company, Columbus, Indiana, USA .. 119
- 3:00 pm *On the Internal Flow of Pressure-Swirl Atomizer at Two Different Density Ratios*, Zhanhua Ma, Dexin Wang, and San-Mou Jeng, University of Cincinnati, Cincinnati, Ohio, USA, and Michael A. Benjamin, Parker Hannifin Corporation, Mentor, Ohio, USA 119
- 3:30 pm **Conference Closes**

SI Engine Sprays II

Chairpersons: J. Drallmeier and T. Baritaud

8:00 am	Invited Paper: <i>Spray and Combustion Modeling in Gasoline Direct Injection Engines</i> , Li Fan and Rolf D. Reitz, University of Wisconsin, Madison, Wisconsin USA 120
8:30 am	<i>Microscopic Investigations of Primary Gasoline Spray Breakup of a High-Pressure Swirl Injector</i> , I. Schmitz, W. Ipp and A. Leipertz, Universität Erlangen-Nürnberg, Erlangen, Germany 120
9:00 am	<i>Spray Characteristics of Gasoline Direct Swirl Injector</i> , Y. K. Park, S. Y. Moon, and C. W. Lee, Kyungpook National University, Taegu, Korea 121
9:30 am	<i>Comparison of the Overall Performance Between an Air-Assisted Fuel Injector and a High-Pressure Swirl Injector</i> , Changsoo Jang and Sangmin Choi, Korea Advanced Institute of Science and Technology, Taejeon, South Korea 122
10:00 – 10:30 am	Break

Diesel Sprays II

Chairpersons: H. Hiroyasu and C. Tropea

10:30 am	<i>Investigation of Primary Diesel Spray Breakup Close to the Nozzle of a Common Rail High Pressure Injection System</i> , C. Heimgärtner and A. Leipertz, Universität Erlangen-Nürnberg, Erlangen, Germany 122
11:00 am	<i>Influence of Injection Parameters of D.I. Diesel Engines on Soot Emission Characteristics</i> , S. Schraml, S. Will and A. Leipertz, Universität Erlangen-Nürnberg, Erlangen, Germany, and T. Zens, ESYTEC GmbH, Erlangen, Germany 123
11:30 am	<i>A Model for Primary Diesel Fuel Atomization Based on Cavitation Bubble Collapse Energy</i> , A. Nishimura, Yanmar Diesel Engine Co. Ltd., Kyoto, Japan, and D. N. Assanis, University of Michigan, Ann Arbor, Michigan, USA 123
12:00 – 1:30 pm	Lunch Break
1:30 pm	<i>Optimization of Diesel Engine Emissions and Fuel Efficiency using Genetic Algorithms and Computational Fluid Dynamics</i> , P.K. Senecal and R.D. Reitz, University of Wisconsin, Madison, Wisconsin, USA 124
2:00 pm	<i>Penetration and Volume of Post-Impingement Diesel Spray</i> , Kyungnam Ko, Tomohiro Momiya, Kenji Amagai, and Masataka Arai, Gunma University, Gunma, Japan 125
2:30 pm	<i>Inter-spray Impingement of Two Diesel Sprays</i> , Takayuki Chiba, Masahiro Saito, Kenji Amagai, and Masataka Arai, Gunma University, Gunma, Japan 126
3:30 pm	Conference Closes

SI Engine Sprays II

Chairpersons: J. Drallmeier and T. Baritaud

- 8:00 am **Invited Paper:** *Spray and Combustion Modeling in Gasoline Direct Injection Engines*, Li Fan and Rolf D. Reitz, University of Wisconsin, Madison, Wisconsin USA 120
- 8:30 am *Microscopic Investigations of Primary Gasoline Spray Breakup of a High-Pressure Swirl Injector*, I. Schmitz, W. Ipp and A. Leipertz, Universität Erlangen-Nürnberg, Erlangen, Germany 120
- 9:00 am *Spray Characteristics of Gasoline Direct Swirl Injector*, Y. K. Park, S. Y. Moon, and C. W. Lee, Kyungpook National University, Taegu, Korea 121
- 9:30 am *Comparison of the Overall Performance Between an Air-Assisted Fuel Injector and a High-Pressure Swirl Injector*, Changsoo Jang and Sangmin Choi, Korea Advanced Institute of Science and Technology, Taejon, South Korea 122
- 10:00 – 10:30 am **Break**

Diesel Sprays II

Chairpersons: H. Hiroyasu and C. Tropea

- 10:30 am *Investigation of Primary Diesel Spray Breakup Close to the Nozzle of a Common Rail High Pressure Injection System*, C. Heimgärtner and A. Leipertz, Universität Erlangen-Nürnberg, Erlangen, Germany 122
- 11:00 am *Influence of Injection Parameters of D.I. Diesel Engines on Soot Emission Characteristics*, S. Schraml, S. Will, and A. Leipertz, Universität Erlangen-Nürnberg, Erlangen, Germany, and T. Zens, ESYTEC GmbH, Erlangen, Germany 123
- 11:30 am *A Model for Primary Diesel Fuel Atomization Based on Cavitation Bubble Collapse Energy*, A. Nishimura, Yanmar Diesel Engine Co. Ltd., Kyoto, Japan, and D. N. Assanis, University of Michigan, Ann Arbor, Michigan, USA 123
- 12:00 – 1:30 pm **Lunch Break**
- 1:30 pm *Optimization of Diesel Engine Emissions and Fuel Efficiency using Genetic Algorithms and Computational Fluid Dynamics*, P.K. Senecal and R.D. Reitz, University of Wisconsin, Madison, Wisconsin, USA 124
- 2:00 pm *Penetration and Volume of Post-Impingement Diesel Spray*, Kyungnam Ko, Tomohiro Momiya, Kenji Amagai, and Masataka Arai, Gunma University, Gunma, Japan 125
- 2:30 pm *Inter-spray Impingement of Two Diesel Sprays*, Takayuki Chiba, Masahiro Saito, Kenji Amagai, and Masataka Arai, Gunma University, Gunma, Japan 126
- 3:30 pm **Conference Closes**

Atomizers II

Chairperson: C.-P. Mao

- 8:00 am *Mass Flow Rate Ratio as the Characteristic Parameter for Coaxial Atomization*, L. Prévost, J.L. Carreau, and F. Roger, Université de Poitiers ENSMA, Futuroscope Chasseneuil, France 134
- 8:30 am *A Study on the Spray Characteristics of an Air Shrouded Injector*, B.G. Kim, K.H. Lee, C.S. Lee, Hanyang University, and Y.H. Seo, Korea Automotive Technology Institute, Korea..... 135
- 9:00 am *Prediction of Atomization Performance of Effervescent Atomizers*, Joo Youn Kim and Sang Yong Lee, Korea Advanced Institute of Science and Technology, Taejon, Korea..... 135
- 9:30 am *Spray Characteristic of Y-Jet-Type Airblast Atomizer Embedding Fluid Amplifier (2nd Report: The Effect of Fluid Amplifier Dimension on Spray Characteristics)*, M. Daikoku, H. Furudate, H. Sakai, and T. Kaga, Hachinohe Institute of Technology, S. Tanno, Tohoku University, and T. Inamura, Hirosaki University, Japan 136
- 10:00 – 10:30 am **Break**
- 10:30 am *Fuel-Injection, Atomization, and Mixing in Pulse Detonation Engines*, C.M. Varga, J.C. Lasheras, E.J. Hopfinger*, and F.A. Williams, University of California, San Diego, La Jolla, California, USA, and *LEGI-CNRS/UJF-INPG, Grenoble, France 137
- 11:00 am *Peculiarities of Liquid Atomization by Means of Porous Swirl Injector*, Vladimir G. Bazarov, Moscow State Aviation Institute, Moscow, Russia 137
- 12:00 – 1:30 pm **Lunch Break**

Spray Instrumentation and Measurements IV

Chairperson: C. Presser

- 1:30 pm *Imaging of Droplets and Vapor Distributions in a Fuel Spray by Using Ultraviolet and Visible Lasers*, Yu-yin Zhang, Takuo Yoshizaki, and Keiya Nishida, University of Hiroshima, Higashi-Hiroshima, Japan 138
- 2:00 pm *Quantitative Visualization of Unsteady Spray by PDA*, Makoto Kaneko, Subaru Research Center Ltd., Tokyo, Japan, and Yuji Ikeda and Tsuyoshi Nakajima, Kobe University, Kobe, Japan 138
- 2:30 pm *Sprays Visualization Using a Mechanical Slicing Device*, Andreas Cronhjort, Royal Institute of Technology, Stockholm, Sweden 139
- 3:00 pm *Advances in Optical Patternation for Sprays, With Applications*, Rick Sellens and Geng Wang 139
- 3:30 pm **Conference Closes**

Posters

- Deformation and Drag Properties of Nonturbulent Round Liquid Jets in Uniform Crossflows*, C. Aalburg, G. M. Faeth, and B. van Leer, Department of Aerospace Engineering, The University of Michigan, Ann Arbor, Michigan, USA 143
- On Factors Influencing the Wetting Angle Behavior after a Molten Microdroplet Impacts a Surface*, D. Attinger, Z. Zhao and D. Poulikakos, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland 145
- Experimental Study on the Effect of Periodical Fluctuation of Fuel Injection Rate on Fuel Spray*, A. Azetsu and N. Ida, The University of Tokyo, Japan 147
- Experimental Investigations of Cryogenic Sprays in Combustion*, Pierre Gicquel and Lucien Vingert, ONERA, Chatillon, France 149
- Simulation of Automotive Electrostatic Rotary-Bell Paint Spray Transfer Processes using KIVA-3V*, Hua Huang and Ming-Chia Lai, Department of Mechanical Engineering, Wayne State University, Detroit, Michigan, USA, and William Meredith, Dupont Automotive, Troy, Michigan, USA..... 151
- Modeling Diesel Spray Combustion Using Detailed Chemical Kinetics Mechanisms*, Song-Chang Kong and Rolf D. Reitz, Engine Research Center, University of Wisconsin, Madison, Wisconsin, USA..... 153
- Utilizing CFD Models to Determine the Internal Flows of Agricultural Chemical Spray Nozzles*, C.L. Lafferty and L.F. Tian, University of Illinois, Urbana, Illinois, USA..... 155
- Microscopic Visualization of High-Pressure Direct-Injection ICE Fuel Spray*, Ming-Chia Lai, Xingbin Xie, T.-C. Thomas Wang, Jong-Sub Han and June-Sung Park, Mechanical Engineering, Wayne State University, Detroit, Michigan, USA..... 157
- A Fully Eulerian Approach to the Simulation of Volatile/Hygroscopic Aerosols*, C.F. Lange and W.H. Finlay, Aerosol Research Laboratory of Alberta, Dept. of Mechanical Engineering, University of Alberta, Edmonton, Alberta, Canada 159
- Analysis of Temperature Characteristics of Nano-Size Cluster Formed after Cluster-Cluster Collision by Molecular Dynamics Simulation*, F. Ohno, T. Okamoto and A. Yokochi, Tokai University, Hiratsuka-shi, Kanagawa-ken, Japan, and T. Oda and S. Usuda, Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken, Japan..... 161
- Simulation Analysis of a Formation Rate of UF_6 Dimers in a Supersonic Flow Process*, Tsuyoshi Okamoto and Ayami Suzuki, Tokai University, Kanagawa, Japan 163
- Spray Characteristics of Heated Nozzle for Gasoline Injection*, Akinori Saito and Kiyomi Kawamura, Engine System Laboratory, Mechanical Engineering Div.1, Toyota Central R&D Labs., Inc., and Yasuhide Tani and Yoshimi Ogihara, Engine Component Engineering Div.1, DENSO CORPORATION, Japan..... 165
- Turbulent Primary Breakup of Round and Plane Liquid Jets in Still Air*, K.A. Sallam, Z. Dai, and G.M. Faeth, Department of Aerospace Engineering, The University of Michigan, Ann Arbor, Michigan, USA..... 167
- The Effect of 2-Phase Feed Conditioning on Proprietary Twin-Fluid Atomizer Performance*, Zahra M. Tafreshi, Deepak Kirpalani, Adam Bennett and Thom McCracken, Institute for Chemical Process and Environmental Technology, National Research Council, Ottawa, Ontario, Canada..... 169
- Spray Simulation Using Fluent*, S. F. C. F. Teixeira, Escola de Engenharia, Universidade do Minho, Portugal, and P. Bowen, and C. J. Bates, University of Wales, UK..... 171