

# 16<sup>th</sup> Ionospheric Effects Symposium



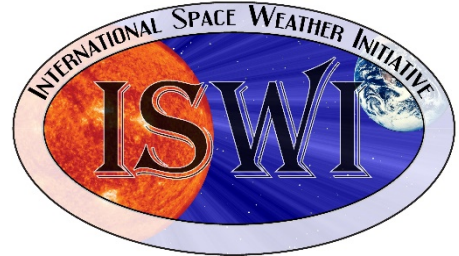
# IES 2023

*Bridging the gap between applications and  
research involving ionospheric and space weather  
disciplines*

**9-11 May, 2023**

**The Hilton Alexandria Old Town,  
1767 King Street, Alexandria VA, 22314**

# Sponsors



## Scientific Organizing Committee

Keith Groves, Boston College (Chair)

Paul Bernhardt, Geophysical Institute, Univ. of Alaska Fairbanks

Jonah Colman, Air Force Research Laboratory

Anthea Coster, MIT Haystack Observatory

Bruce Fritz, Naval Research Laboratory

Dima Paznukhov, Boston College

## Local Organizing Committee



Keith Groves, Kathleen Kraemer, Andrea Murphy, Sean O'Connell,  
Daneille Berzinis, Bonnie Delay, Boston College Institute for  
Scientific Research

# Logistics

## REGISTRATION DESK

Please pick up your registration materials at the desk near the  
Grand Ballroom Foyer

Registration desk will be open at the following times:

<b>Monday May 8</b>	<b>6 – 7:30 PM</b>
<b>Tuesday May 9</b>	<b>7:00 AM – 3:30 PM</b>
<b>Wednesday May 10</b>	<b>8:00 AM – 3:30 PM</b>
<b>Thursday May 11</b>	<b>8:00 – 8:45 AM</b>

## CONTINENTAL BREAKFAST

A light continental breakfast will be served beginning at 7:30 AM  
Tuesday and at 8:00 AM Wednesday & Thursday

Posters will be exhibited Tuesday – Thursday in the Grand  
Ballroom Foyer

The Conference website is <https://bc.edu/ies2023>

## PRESENTATIONS

Presentations must be turned in ahead of time in order to be loaded onto the conference computers, preferably by email to [ies@bc.edu](mailto:ies@bc.edu) or [Kathleen.kraemer@bc.edu](mailto:Kathleen.kraemer@bc.edu); thumbdrives & CDs acceptable;

*pdf or ppt(x) only*

**Morning sessions: 5:30 pm the day before your talk**

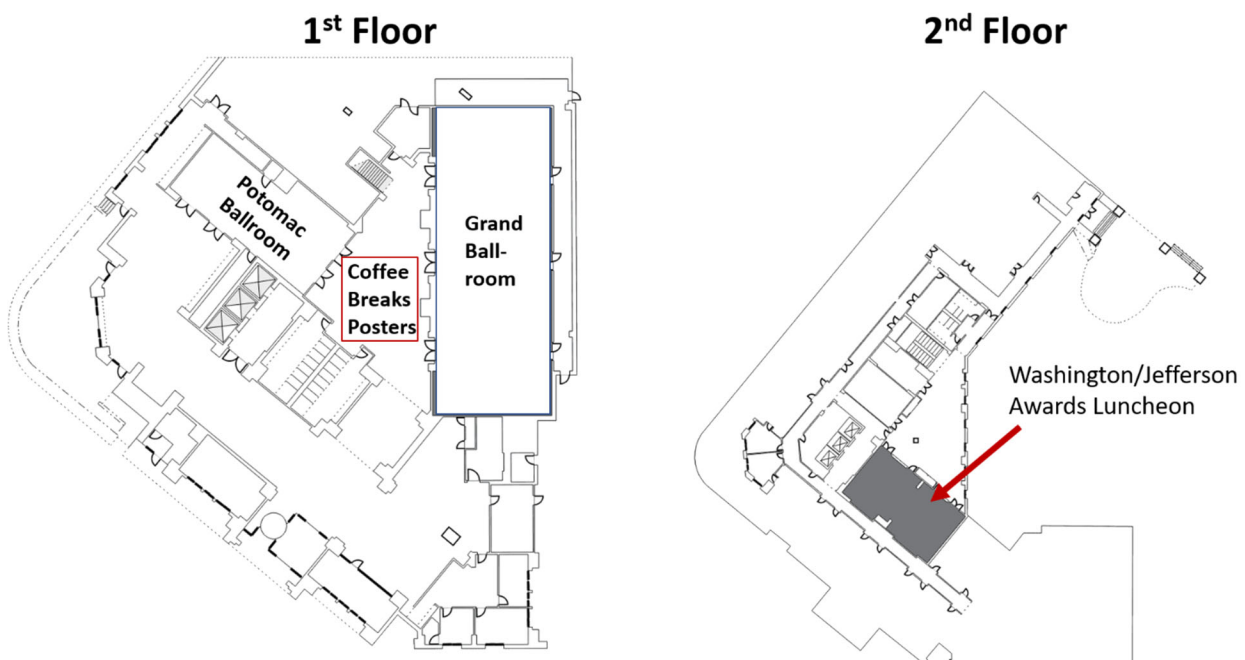
**Afternoon session: 10:15 am the day of your talk**

## SESSION LOCATIONS

The Plenary session on Tuesday morning and Track A sessions will be held in the Grand Ballroom on the 1<sup>st</sup> floor. Track B sessions will be held in the Potomac Ballroom, also on the 1<sup>st</sup> floor.

Weather permitting, the Ice-breaker reception will be in the Courtyard. Rain location TBD.

The Awards Luncheon (Wednesday) will be held in the Washington/Jefferson Room on the 2<sup>nd</sup> floor.



# Ionospheric Effects Symposium 2023

May 9-11 Alexandria, VA, USA

	Monday 8-May	Tuesday 9-May	Wednesday 10-May	Thursday 11-May
7:00 AM				
7:30 AM		Registration opens Light Breakfast		
8:00 AM		<b>Plenary</b>  Agency Updates	Registration & Light Breakfast	Registration & Light Breakfast
8:20 AM			4A	8A
8:40 AM			4A	8A
9:00 AM			4A	8A
9:20 AM		Solar Cycle 25	4A	8A
9:40 AM				
10:00 AM		Break	Break	Break
10:20 AM		Break	5A	9A
10:40 AM		1A	5A	9A
11:00 AM		1A	5A	9A
11:20 AM		1A	5A	9A
11:40 AM		1A	5A	9A
12:00 PM		Lunch (on your own)	<b>Awards Luncheon</b>	
12:20 PM				
12:40 PM				
1:00 PM				
1:20 PM		2A	6A	Plenary: Grand Ballroom
1:40 PM		2A	6A	
2:00 PM		2A	6A	Track A: Grand Ballroom
2:20 PM		2A	6A	
2:40 PM		2A	6A	Track B: Potomac Ballroom
3:00 PM		2A	6A	
3:20 PM		Break	Break	
3:40 PM		3A	7A	Awards Luncheon: Wash./Jeff.
4:00 PM		3A	7A	
4:20 PM		3A	7A	
4:40 PM		<b>Ice-Breaker Reception 4:30-6:00</b>	7A	
5:00 PM				
			The Hilton Alexandria Old Town, 1767 King Street, Alexandria, Virginia, 22314, USA	
6:00 PM	Registration Open			
7:30 PM				

**Tuesday**

- 1A HF Modeling, TIDS, & Geolocation I
- 2A HF Modeling, TIDS, & Geolocation II
- 3A Radio Occultation Methods
- 1B Space Weather Applications & Services I
- 2B Space Weather Applications & Services II / Topside Ionosphere

**Wednesday**

- 4A HF Modeling & Measurements I
- 5A Scintillation & Propagation I
- 6A Scintillation & Propagation II
- 7A Active Experiments & Radar
- 3B Lower Thermosphere & Sporadic E
- 4B Optical Remote Sensing
- 5B Storm Effects

**Thursday**

- 8A Assimilative & Coupled Models
- 9A HF Modeling & Measurements II



## TECHNICAL PROGRAM

**Monday, May 8**

**6-7:30 pm Registration Desk Open**

**Tuesday, May 9**

**07:00 Registration & light breakfast**

**08:00 Plenary Session – Agency Updates, Solar Cycle 25**

**Chair: Keith Groves**

08:00	Welcome and Introduction	<i>Keith Groves</i>
08:15	Basic Research in Space Science at AFOSR	<i>Julie Moses</i>
08:30	Space Weather Activities at ONR	<i>Bruce Fritz</i>
08:45	NSF Geospace Sciences Funding Opportunities	<i>Tai-Yin Huang</i>
09:00	Ionospheric and Space Weather Activities at NASA	<i>James Spann</i>
09:15	Ionosphere Products and Services at the NOAA Space Weather Prediction Center	<i>Tzu -Wei Fang</i>
09:30	Ionospheric Effects on FAA Systems: WAAS and GBAS	<i>John Mick</i>
09:45	Update on Solar Cycle 25	<i>Pertti Makela</i>
10:00	Solar Cycle 25: Analysis of Recent Space Weather Events <i>Anthea Coster, N. Aponte, S.-R. Zhang, L. Goncharenko, S. Derghazarian</i>	

**10:20 – 10:40 am Coffee Break**

**10:40 – 12:00 Parallel Science Sessions 1A & 1B**

**Track A will be in the Grand Ballroom and Track B will be in the Potomac Ballroom**

	<b>A Sessions – Grand Ballroom</b>	<b>B Sessions – Potomac Ballroom</b>
	<b>1A: HF Modeling, TIDS, &amp; Geolocation I</b> <b>Chair: Jonah Colman</b>	<b>1B: Space Weather Applications &amp; Services I</b> <b>Chair: Joe Huba</b>
10:40	Using GNSS instantaneous phase differential to geolocate acoustic sources from August 2022 bolide <i>Erin Lay, J. Tippmann, X.-M. Shao, R. Haaser</i>	Operational Assimilative Ionospheric Models in Europe and the UK  <i>Sean Elvidge, D. Themens</i>
11:00	Large Scale Traveling Ionospheric Disturbances in the Topside Ionosphere <i>Angeline Burrell, M. Dhadly, K. Zawdie, F. Sassi</i>	The Development of the Radio Frequency Ionospheric Scintillation Attribution (RISA) Tool <i>Dallin Smith, R. Caton, K. Groves, T. Beach, C. Carrano, A. Hoskinson, W. McNeil, D. Mizuno</i>
11:20	High frequency surface wave oceanographic research radars as bistatic single frequency oblique ionospheric sounders and day-to-day ionospheric variability <i>Stephen Kaeppler, E. Miller, D. Markowski, L. Coleman</i>	Combining Ground- and LEO-RO-Based GNSS Observations in Real-time Operational Space Weather Products <i>Tibor Durgonics, T.-W. Fang, T. Onsager, F. Centinello, J. Wang, D. Fuller-Rowell, M. Codrescu</i>
11:40	Validating and Improving a Realistic Ionospheric Truth Model for Observing System Simulation Experiments of HF Propagation  <i>Ian Collett, J. Hughes, W. Wilson, G. Crowley, J. Colman, R. Landry</i>	Latest Developments on JPL’s Global Ionospheric Mapping Software Suite: Multi-GNSS Support, High-Cadence, Near-Real-Time, and Error Quantification <i>Léo Martire, D. W. Green, B. A. Ijima, A. Komiáthy, S. Krishnamoorthy, A. J. Mannucci, X. Meng, A. W. Moore, T. F. Runge, P. Vergados, O. P. Verkhoglyadova</i>

**12:00 – 13:20 pm Lunch – on your own**

**13:20 – 15:00 Parallel Science Sessions 2A & 2B**

	<b>2A: HF Modeling, TIDS, &amp; Geolocation II</b> <b>Chair: Austin Egert</b>	<b>2B: Space Weather Applications &amp; Services II/ Topside Ionosphere</b> <b>Chair: Rezy Pradipta</b>
13:20	Over-the-horizon (OTH) Propagation: Ray Trace Model and Measurement Matching <i>James Conroy, S. Ellison, F. McFadden, J. Wiker, J. Outwater</i>	Finding Space Debris with Orbit Driven Plasma Waves in the Ionosphere  <i>Paul Bernhardt, L. Scott, A. Howarth</i>
13:40	Interpreting the Doppler shift of Transionospheric HF radio waves <i>Donald Danskin, R. Gillies, E. Ceren Eyiguler, K. Pandey, G. Hussey, A. Yau</i>	A Verification and Validation of the Observation System Simulation Experiment Tool  <i>Joe Hughes, I. Collett, A. Reynolds, G. Crowley</i>
14:00	Attitude effects on the observed orientation angle of HF waves from the Radio Receiver Instrument on e-POP/Swarm-E	Connections Between Stratospheric and Mesospheric Gravity Waves, Winds and Traveling Ionospheric Disturbances

	<i>E. Ceren Eyiguler</i> , D. Danskin, A. D. Howarth, W. Holley, K. Pandey, R. G. Gillies, A. W. Yau, G. C. Hussey	<i>Sevag Derghazarian</i> , L. P. Goncharenko, S.-R. Zhang, A. J. Coster, V. L. Harvey, C. Randall
14:20	Applications of a Novel Modular High Frequency Measurement Platform in Ionospheric Observation <i>Torsten Reuschel</i> , A. Kashchev, P. Trottier, T. Jayachandran	Modeling Plasmasphere Structure: Ducts and Irregularities <i>Joe Huba</i> , H.-L. Liu, E. Becker
14:40	Improving IRI's topside formulation for a better assimilation of GNSS TEC data during the local winter <i>Nina Servan-Schreiber</i> , D. Paznukhov*	Topside Ionosphere Electron Density Modeling with Empirical and Machine Learning Techniques <i>Shweta Dutta</i> , M. Cohen

### 15:00 – 15:20 Coffee Break

### 3A: Radio Occultation Methods Chair: Tibor Durgonics

15:20	A Limb-to-disk Algorithm for Mapping Scintillation Observations Along Radio Occultation Ray-paths to the Vertical Propagation Geometry <i>Charles Carrano</i> , K. Groves, W. McNeil, E. Yizengaw, P. Straus, R. Caton, D. Smith
15:40	Ionospheric Profile Retrievals using 1D-Var with COSMIC-2 Bending Angles <i>Sean Elvidge</i> , I. D. Culverwell, S. B. Healy
16:00	Global Observations of Sporadic-E and Spread-F Occurrence Rates Using the COSMIC-2 Constellation <i>Kenneth Dymond</i>

### 16:30 – 18:00 Ice Breaker Reception

### 18:00 Adjourn for the day – Dinner on your own

### Poster Session Tuesday - Thursday (all-day)

<b>Ionospheric Effects During Moderate Earthquake in Japan on 5 September 2018</b> <i>Yiyang Luo</i> , L. Chernogor, K. Garmash, Q. Guo, S. Shulga, Y. Zheng
<b>Detection of Spread-F, foF2 values and Planetary and Gravity Wave Signatures using Digisonde instruments and their comparison with COSMIC-1/FORMOSAT-3, SAMI and IRI data</b> <i>Preeti Bhaneja</i> , T. Bullett, J. Klenzing
<b>Ionospheric Effects of Geospace Storm 5-6 August 2019</b> <i>Yiyang Luo</i> , L. Chernogor, K. Garmash, Q. Guo, Y. Zheng



## Wednesday, May 10

**08:00 Registration & light breakfast**

### **4A HF Modeling and Measurements I Chair: Jonah Colman**


08:40	The Incorporation of Near Real Time Ionospheric Propagation Information for Automated Link Establishment Based Communication Systems <i>William Batts, W. Furman, R. Buckley, J. Nieto</i>
09:00	A Vertically-Resolved Model for Ionospheric Absorption of HF radio waves due to solar protons and X-rays <i>Anton Goertz, C. Jeffery</i>
09:20	Automatic real-time tool for processing of oblique sounding data <i>Dima Paznukhov, K. Kraemer, T. Beach, B. Drummond, M. Proctor, K. Groves</i>
09:40	Changes in Polarization State of Transionospheric Radio Waves Driven by Difference in O- and X-mode Powers <i>Kuldeep Pandey, E. C. Eyiguler, D. W. Danskin, R. G. Gillies, A. W. Yau, G. C. Hussey</i>

**10:00 – 10:20 Coffee Break**

**10:20 – 11:40 Parallel Science Sessions 5A & 3B**

	<b>A Sessions – Grand Ballroom</b>	<b>B Sessions – Potomac Ballroom</b>
	<b>5A: Scintillation &amp; Propagation II</b> <b>Chair: Romina Nikoukar</b>	<b>3B: Lower Thermosphere &amp; Sporadic E</b> <b>Chair: Kenneth Dymond</b>
10:20	Generation of Realizations of Electron Density for Numerical Electromagnetic Propagation Simulations  <i>Dennis Knepp, V. Sotnikov</i>	Comparisons of the Data-Driven D Region (D3R) Model to Incoherent Scatter Radar Observations During the Active Solar Conditions of September 2017 <i>Austin Egert, J. V. Eccles, J. M. Holmes, J. Malins</i>
10:40	New Utilities for Diagnostic Ionospheric Signal Processing  <i>Chuck Rino, C. Carrano, K. Groves, M. Proctor, D. Paznukhov</i>	Sferic-based tomography for D-region imaging  <i>David Richardson, M. Cohen*</i>
11:00	An Empirical Mid-Latitude Model of the CkL Irregularity Index from 35 MHz Scintillation Data <i>Joseph Helmboldt, B. Hicks, J. Coumbs, G. Taylor, J. Dowell</i>	The importance of electric field in ions convergence and formation of sporadic E (Es) at the equatorial region <i>Goderdzi Didebulidze, G. Dalakishvili, M. Todua, L. Toriashvili</i>
11:20	Identifying and Attributing Signal Distortions Using Machine Learning Techniques <i>Matthew Proctor, C. Rino, K. Groves, D. Paznukhov, D. Smith</i>	Reconstruction of the Electron Precipitation Spectrum Based on Modeling of Auroral Optical Emission Tomography  <i>Anton Goertz, D. Whiter</i>

**12:00 – 13:40: Awards Luncheon & Keynote Lecture (Washington/Jefferson, 2<sup>nd</sup> floor)**

<p><b>Keynote Lecture:</b>  <b>JWST’s First Look at the Universe</b>  <i>Dr. Macarena Garcia Marin, JWST Deputy Project Scientist</i></p>	
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**13:40 – 15:20 Parallel Science Sessions 6A & 4B**

	<b>6A: Scintillation &amp; Propagation II</b> <b>Chair: Dallin Smith</b>	<b>4B: Optical Remote Sensing</b> <b>Chair: Morris Cohen</b>
13:40	Sporadic-E and GNSS Scintillation  <i>Theodore Beach</i>	The Experiment for Characterizing the Lower Ionosphere and Prediction Sporadic-E (ECLIPSE) Missions: Instruments to Study the Dynamics of the Lower Ionosphere <i>Kenneth Dymond, A. C. Nicholas, B. A. Fritz, S. A. Budzien, A. W. Stephan, C. M. Brown, E. J. Wagner, M. R. Burleigh, D. P. Drob</i>
14:00	A study of the relative dynamics of ionospheric irregularities and GPS satellites on receiver tracking performance from a low-latitude station in the Indian longitudes <i>Ashik Paul, T. Biswas</i>	Detrending GOLD EUV Data to Reveal Equatorial Plasma Bubble Structures  <i>Rezy Pradipta, K. Groves, C. Huang</i>
14:20	Estimation of Ionospheric Scintillation Index S4 from Rate of Change of Total Electron Content Index (ROTI) in Low Latitudes <i>Teddy Surco Espejo, C. Carrano, K. Groves, T. Beach</i>	The Variable Voltage Ion Protection Experiment (VVIPRE): Thermospheric and Ionospheric Remote Sensing from the ISS  <i>Scott Budzien, K. Dymond, B. Fritz, A. Nicholas, A. Stephan, E. Wagner</i>
14:40	Revisiting refractive contribution to radio wave scintillation for polar cap applications <i>Romina Nikoukar, L. Lamarche, A.-M. Bals, K. Deshpande</i>	Characterization of the Daytime Ionosphere with ICON EUV Airglow Limb Profiles  <i>Andrew Stephan, M. Sirk, E. Korpela, S. England, T. Immel</i>
15:00		First-year Results from a Space-based Sporadic-E Detector <i>Bruce Fritz, K. Dymond, A. Nicholas, S. Budzien, A. Stephan</i>

**15:20 – 15:40 Coffee Break**

**15:40 – 17:00 Parallel Science Sessions 7A & 5B**

	<b>7A: Active Experiments &amp; Radar Chair: Natasha Jackson-Booth</b>	<b>5B: Storm Effects Chair: Anthea Coster</b>
15:40	Using the Ionosphere to Amplify Whistlers and EMIC Waves from Ground Transmitters for Reduction of Radiation Belt Particle Populations <i>Paul Bernhardt, M. Hua, J. Bortnik, O. Ma, V. Harid, M. Golkowski, A. Howarth</i>	The Onset and Development of Nitric Oxide Production During ICME-Driven Storms  <i>Kevin Delano, D. Oliveira, E. Zesta</i>
16:00	Reviving High-Speed Releases using Sounding Rockets and the Space Measurements of A Rocket-Released Turbulence (SMART) Experiment <i>Carl Siefiring, G. Ganguli, G. Gatling, J. Coombs, C. Crabtree, A. Fletcher, W. Amatucci, C. Netwall, N. Falcone, W. Ferrell, R. Holzworth, M. McCarthy</i>	Global Responses of Equatorial/Low-Latitude Ionosphere to CME-driven and CIR-driven Geomagnetic Storms  <i>Andrew Akala, Y. Otsuka, O. J. Oyedokum, J. Umunna</i>
16:20	HF scattering of ocean waves using HAARP  <i>Stanley Briczinski, J. Coombs, C. Siefiring, P. Bernhardt, M. Sletten, M. McCarrick, A. Howarth, H. G. James</i>	Monitoring High-Latitude HF Absorption using Space-Based Lightning Measurements  <i>Michael Peterson, C. Jeffery</i>
16:40	Development of an Autonomous RF System that exploits SuperDARN Signals for Bistatic Radar Imaging of High-Resolution Ionospheric Structures near HAARP <i>Christopher Jeffery, X.-M. Shao, A. Beveridge, I. Cummings, G. Cunningham, C. Fallen, B. Haynes, E. Lay, E. Nelson, J. Reisner, J. Rushton</i>	Gradient drift instability and decameter ionospheric irregularities at the edge of polar holes  <i>Scott Thaller, J. Hughes, G. Crowley, J. Noto, R. Blay</i>

**17:00 Adjourn for the day – Dinner on your own**

## Thursday, May 11

**08:00 Registration & light breakfast**

### **8A: Assimilative and Coupled Models    Chair: Sean Elvidge**

08:40	Assimilative Modeling of the Ionospheric Layers <i>Victoriya Forsythe, S. McDonald, D. Kuhl, B. Fritz, K. Diamond</i>
09:00	Data-Assimilative Ionospheric Profile Specification Using Scaled IRI Parameters <i>Alan Hoskinson, D. Paznukhov, W. J. McNeil, M. Proctor, C. S. Carrano, K. M. Groves</i>
09:20	Modeling the Day-to-Day Variability of Midnight Equatorial Plasma Bubbles with SAMI3/WACCM-X <i>Min-Yang Chou, J. Yue, F. Sassi, J. Huba, S. McDonald, J. Tate, N. Pedatella, C. Randall, L. Harvey</i>
09:40	A "Prediction Model" for the Occurrence or No-occurrence of Density Irregularity in Space Constructed with the ROCSAT Data <i>Shin-Yi Su, H.-H. Ho, C.-K. Chao, L.-C. Tsai, C. H. Liu</i>

**10:00 – 10:20 Coffee Break**

### **9A: HF Modeling and Measurements II    Chair: William Liles**

10:20	MF Scattering from the Exponential D-Region: Analytic Theory & Double-Peaked Ground Signatures <i>Christopher Jeffery</i>
10:40	An Improved Starting Field for Full Wave Modeling of High-Frequency Propagation in the Ionosphere <i>Charles Carrano, C. L. Rino, L. Fishman</i>
11:00	Forward Propagation Geometrical Optics and Beam Steering <i>Chuck Rino, C. Carrano, K. Groves</i>
11:20	Simultaneous Measurements of Temporal and Spatial Phase Structure Functions of an HF Skywave Signal at Mid-Latitudes <i>Joe Helmboldt</i>
11:40	Responses of the Nigerian low-latitude ionosphere to geomagnetic storms of the ascending and maximum phases of solar cycle 24 <i>E. Oyeyemi, A. O. Akala, D. Okoh, O. O. Odeyemi, B. Olugbon, P. O. Amaechi, O. J. Oyedokun, O. R. Idolor</i>

**12:00 – Workshop Wrap-up & Adjourn**