Laser Communication and Propagation through the Atmosphere and Oceans XII (OP430)

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This conference provides a forum for researchers, engineers, and system developers to present and discuss advances in communication and imaging systems operating in the Earth's atmosphere, near-water, and underwater environments. We aim to stimulate interdisciplinary discussions of atmospheric turbulence, light wave propagation, and their effects on these systems. Submissions are encouraged from all institutions, including defense, commercial, and academic.

The effects of the atmosphere and oceans on optical propagation can often be the limiting performance factor in many optical systems. The primary factors in beam degradation are absorption and scattering, large-scale refractive effects, and optical turbulence. For many applications, it is necessary to predict and model these effects in order to mitigate them. Specific environments remain difficult to model: long horizontal propagation paths near or through the ocean or land surface can encounter large vertical gradients in turbulence intensity and in extinction. Inhomogeneous regions such as coastal areas, mountains, or urban islands are also difficult to model.

High data rate free-space optical (FSO) communication through the atmosphere, space, air-water interface and underwater remains an emerging technology with several technical challenges driven by turbulence effects. These challenges include signal detection, beam control (pointing, acquisition, tracking, steering), scintillation, laser speckle, coupling into fiber, system design, and information processing. Similarly, single-photon free-space communication systems used for establishing secure quantum-key-distribution (QKD)-based links over long distances are subject to the same atmospheric and system challenges described above. As FSO progresses towards 100Gbps data rates, systems move from intensity modulation and direct detection to coherent modulation systems requiring light manipulation in single-mode fiber. Novel beams including Orbital Angular Momentum (OAM) also have applications here.

For imaging systems, atmospheric effects may lead to serious degradation of image quality, e.g., through contrast reduction, blurring and scintillation. Over the paths described above imaging is often dominated by anisoplanatic tip and tilt distortions rather than blurring alone. In these situations the imaging forward model is shift variant and can confound approaches normally applied to mitigate turbulence induced degradations.

We encourage submissions that address:

- modeling or experiments of the atmospheric interaction and propagation involving novel sources such as supercontinuum lasers
- modeling and detection of beams featuring Orbital Angular Momentum (OAM) over long horizontal paths for FSO applications
- modeling and experiments of the atmospheric effects on coherent FSO systems, such as phase ambiguity, depolarization, channel capacity and free space coupling of light into single-mode fiber
- experimental demonstrations or system modeling of Quantum FSO communications in the atmosphere or over underwater links
- imaging formation and mitigation in scenarios where the isoplanatic angle is on the order of or smaller than the diffraction limit of the imaging system
- light-field approaches applied to understanding the effects of atmospheric and oceanic turbulence on light propagation
- application of machine learning (ML) algorithms to atmospheric propagation data, such as scintillation and imaging
- modeling and experiments with optical time transfer through the atmosphere and different propagation media, such as fog, rain and underwater.

Papers are solicited in the following and related areas:

- LIDAR and application of remote sensing tools to describe the atmospheric propagation environment
- measurement and modeling of the effects of turbulence, aerosols, precipitation and particulates on laser beam propagation and imaging systems
- single-photon FSO communication systems over turbulent paths
- underwater FSO communications and propagation in oceans
- mitigation techniques for FSO and imaging systems
- light-field approaches to imaging through turbulence
- optical components for use in FSO systems especially those related to detection of OAM and QKD
- use of broadband laser sources to simultaneously characterize absorption, scattering, and turbulence over a range of wavelengths
- experimental demonstrations, tests, and performance characterizations in laboratory and field
- outdoor experiments with lasers in the 2µm regime
- coherent free-space optical communications.

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<tr>
<td>Abstracts due</td>
<td>8 March 2023</td>
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<td>Registration opens</td>
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<td>Authors notified and program posts online</td>
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<td>Submission system opens for manuscripts and poster PDFs*</td>
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<td>Poster PDFs due for spie.org preview and publication</td>
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<td>Advance upload deadline for oral presentation slides**</td>
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*Contact author or speaker must register prior to uploading

**After this date slides must be uploaded onsite at Speaker Check-In

**What you will need to submit**

- **Title**
- **Author(s) information**
- **250-word abstract for technical review**
- **100-word summary for the program**
- **Keywords used in search for your paper (optional)**
- **Check the individual conference Call for Papers for additional requirements**

Note: Only original material should be submitted. Commercial papers, papers with no new research/development content, and papers with proprietary restrictions will not be accepted for presentation.

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- Submit a manuscript by the advertised due date for publication in the Proceedings of SPIE in the SPIE Digital Library
- Obtain funding for registration fees, travel, and accommodations
- Ensure that all clearances, including government and company clearance, have been obtained to present and publish; if you are a DoD contractor in the USA, allow at least 60 days for clearance
- Attend the meeting
- Present at the scheduled time

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For questions about your presentation, submitting an abstract post-deadline, or the meeting, contact your Conference Program Coordinator.