22nd Monthly Colloquium- Abstract

ZBLAN Fiber Lasers: Unlocking Broad-Spectrum Photonic Applications from UV to Mid-Infrared

ZBLAN fiber lasers, derived from fluoride-based glass, have gained increasing attention for their ability to operate across an exceptionally wide spectral range—from ultraviolet (UV) and visible wavelengths to the mid-infrared (mid-IR). Unlike conventional silica fibers, ZBLAN offers low phonon energy, high rare-earth solubility, and broad optical transparency (0.2–7 µm), making it an ideal host for efficient lasing in spectral regions previously inaccessible to silica-based systems. These attributes have enabled the development of compact, high-performance fiber lasers for diverse applications, including biomedical imaging and surgery, environmental sensing, UV/blue light generation, optical communications, and defense systems.

This presentation highlights recent progress in rare-earth-doped ZBLAN fiber lasers, with a focus on Er^{3+}, Tm^{3+}, and Ho^{3+} dopants, emphasizing their lasing mechanisms, wavelength coverage, and design innovations. Additionally, it outlines ongoing research challenges—such as fiber reliability, power scaling, and nonlinear limitations—and explores future directions for expanding ZBLAN's capabilities in both short and long wavelength photonics.