



# University of Central Florida

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## Amplify Space-Multiplexed Optical Signals

In efforts to keep up with higher and higher bandwidth demand, multiplexing techniques offer promising ways to increase the capacity of current fiber infrastructure, including space-multiplexed optical transmission. While multimode and multicore fibers can multiply fiber capacity, space-multiplexed optical transmission remains limited to several tens of kilometers without a practical amplification technique. Previous amplification techniques have been unsatisfactory, or, at best, leaving room for improvement; commercial erbium-doped fiber amplifiers (ED-FAs) can't be used in space-multiplexed transmission.

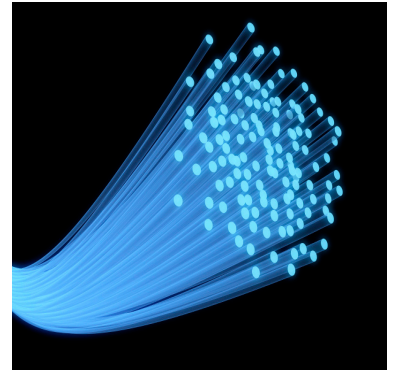
Developed by UCF researchers, a new technique called imaging amplification allows space multiplexing to increase fiber capacity in practical application. Increasing the number of cores allows an increase in total input power for the signal beams, increasing the optical power conversion efficiency for the imaging amplifier within a space-multiplexed optical transmission system. Compared to ED-FAs, an imaging amplifier is simpler, since it can be used to amplify signals from many cores, with each core supporting one or several spatial modes. When multi-core fibers are used, involving higher total input power, optical power conversion efficiency as high as 50% has been achieved.

### Technical Details

The imaging amplification technique exploits the parallelism in bulk optics to provide the additional degrees of freedom needed to amplify signals from multi-core and multimode fibers. The facet of an input multimode or multi-core fiber is mapped or imaged to the facet of an output fiber after passing through an amplifying region. An image amplifying system can be comprised of an input fiber, a first lens, a bulk amplifier that comprises a gain medium, a second lens, and an output fiber. The input and output fibers should be substantially identical, the same multimode fibers or the same multi-core fibers. The lenses can be individual lenses or groups of lenses. The bulk amplifier comprises a single mass of material, such as silica or phosphate glass, that is doped with an appropriate amplifying medium, such as erbium, erbium/ytterbium, or any other element or elements that provide gain at the signal wavelength. The image amplifying system can also incorporate components including a side or longitudinal pump and a reflector that reflects unabsorbed pump energy back to the bulk amplifier.

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### Benefits

- Reduces number of components required
- High optical power conversion efficiency

### Applications

- Space-multiplexed optical transmission systems

### Tech Fields

Optics & Lasers

### Keywords

space-multiplexed, signal amplification, multi-core fibers, multimode fibers, bulk amplifier

### Patent Application Pub. No

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**If you or your company are interested in this opportunity, Contact:**

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