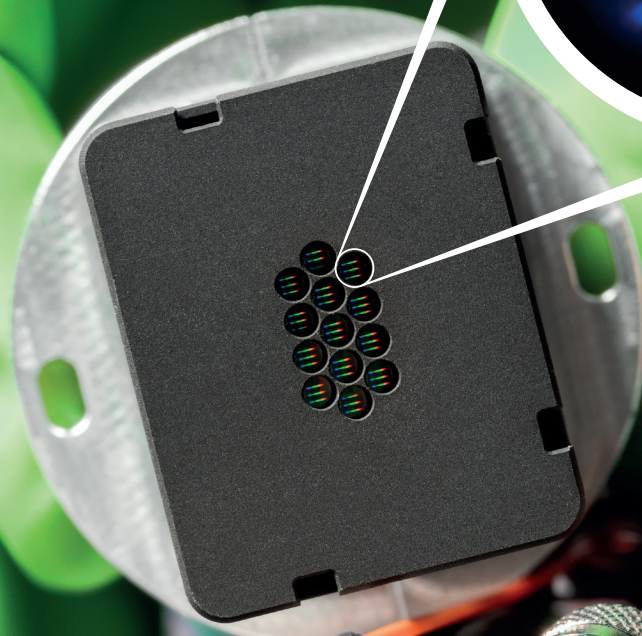
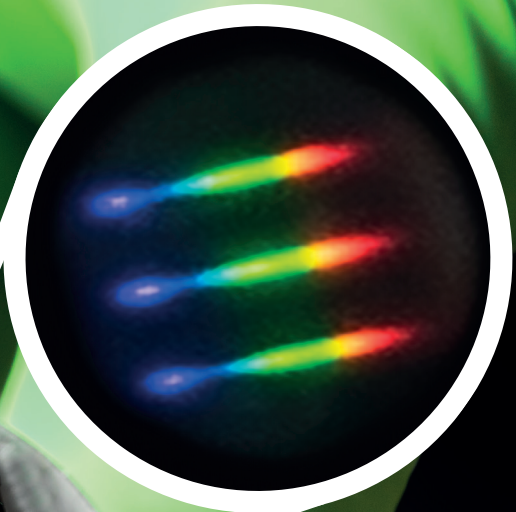




**Fraunhofer**  
IOF

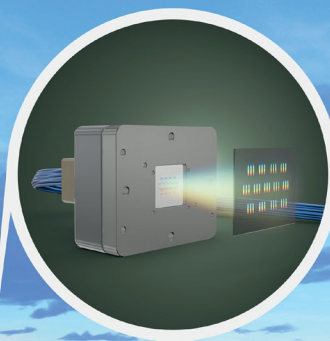
Fraunhofer Institute for Applied  
Optics and Precision Engineering IOF



# Miniaturized parallel spectroscopy

Fiber-coupled array spectrometer





# Miniaturized parallel spectroscopy

## Fiber-coupled array spectrometer

Cover: Photo of the array spectrometer's image plane without the image sensor

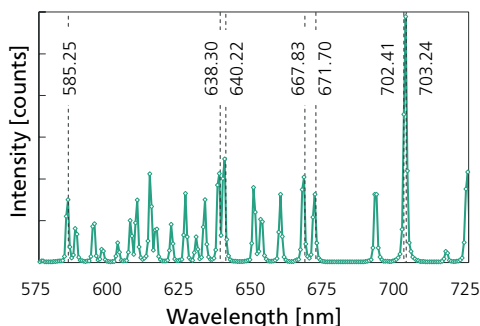
Top: Artistic illustration of system application in digital farming

### Aim

Parallel spectroscopy in the visible spectral range is applied in various analytical tasks ranging from industrial inspection via digital farming to life sciences. To address parallel distributed sensing applications, a fiber-coupled system has been developed. Utilizing micro-optics array technologies in combination with standard CMOS image sensor yields a very compact system for parallel snapshot spectral sensing.



Optical unit without fiber array and image sensor.



Section of a measured spectrum indicating the wavelengths of some selected spectral lines (Avantes Neon calibration lamp)

### Technology

- Grating spectrometer array utilizing a meta grating in PGP configuration
- High diffraction efficiency (>70%) across the full spectral range
- Optical micro-lens arrays for collimation and imaging replicated in wafer scale technology
- Passively mounted optical system, only fiber array and image sensor aligned actively

### Specifications

- Up to 39 input fibers analyzed in parallel (depending on image sensor)
- Spectral range 400 ... 800 nm; achromatic system design can be extended to NIR range < 1'600 nm
- Dispersion approx. 0.6 nm/pixel
- < 3 nm spectral linewidth @ 650 nm
- Optical system's track length < 18 mm with 24 x 19 mm<sup>2</sup> lateral size
- Convertible to an imaging array spectrometer (without fiber input)

### Contact

Department  
**Optical and Mechanical  
System Design**

Scientific Group  
**Micro-Optical Systems**  
Dr. Norbert Danz  
Phone +49 3641 807-750  
norbert.danz@iof.fraunhofer.de

Fraunhofer IOF  
Albert-Einstein-Strasse 7  
07745 Jena  
Germany

[www.iof.fraunhofer.de](http://www.iof.fraunhofer.de)



check  
[www](http://www.iof.fraunhofer.de) for  
more info