

# A Novel and Simplified Hyperspectral Snapshot Imaging System

A new method of hyperspectral snapshot imaging has been developed. It is based on diffraction in an intermediate image plane. This invention avoids the difficult manufacturing of the mosaic-filtering array, but the spatial and spectral resolution will still become coupled.

- stable filter response
- Can be Customized: choosing any arbitrary spatio-spectral patterns for any given application is possible.
- The final product is expected to be significantly less expensive compared to current solutions.

## Fields of application

A competitor for any Spectral Resolving Filter Arrays (SERFAs) systems with broad applications in agriculture and food, environmental monitoring, medical imaging, remote sensing, security and defence, etc.



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### Development Status

TRL3 - Prototyp

### Patent Situation

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US 18/050,334 pending

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21/058TLB

### Service

Technologie-Lizenz-Büro GmbH  
has been entrusted with exploiting  
this technology and assisting  
companies in obtaining licenses.

## Background

Multi- and Hyperspectral Imaging (HIS) systems are important technologies for a variety of applications. Commercially available technologies are spectral resolving filter arrays (SRFAs) which are very expensive if not used with the standard red-green-blue pattern due to their complex manufacturing process.

## Problem

Spectral Resolving Filter Arrays (SERFAs) offer significant potential in hyperspectral imaging, but there are challenges ahead of their development. One primary obstacle is the intricate design and manufacturing requirements, demanding precision that can be time-consuming and costly.

Balancing the trade-off between achieving high spectral resolution and maintaining spatial resolution is another critical challenge, as increasing spectral bands may compromise image clarity, particularly in applications where both fine spectral and spatial details are essential, such as medical imaging or remote sensing. Additionally, integrating SERFAs into existing imaging systems poses compatibility issues, requiring careful consideration of optical and electronic interfaces for seamless operation.

Overcoming these challenges is essential to fully harness the capabilities of SERFAs across diverse imaging applications, from agriculture and environmental monitoring to medical diagnostics and industrial inspection.

## Solution

Researchers at the University of Stuttgart have developed a novel, inexpensive, and simple solution to overcome these challenges. The working principle of this method is demonstrated in Fig 1. A specific pattern of micro gratings realises a lithographically fabricated Diffractive Optical Element (DOE), an aperture stop is used for spectral filtering. A prototype of this invention has been developed and tested successfully.

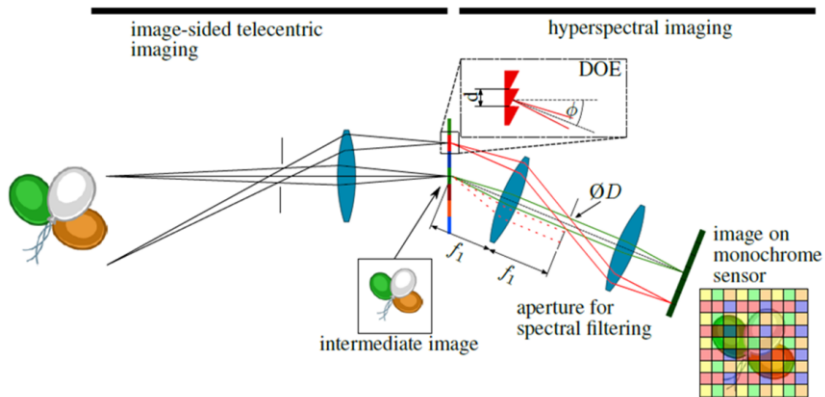


Figure 1: Principle of this novel hyperspectral detection. Microgratings in an intermediate image plane deflect the light towards a spectral filtering iris. Each Microgratings is optimised for an individual application depending on wavelengths [R. Hahn, Institute for Technical Optics (ITO), University of Stuttgart]

### Publication and links

Tobias Haist, Robin Hahn, Stephan Reichelt, "Diffraction-based dual path multispectral imaging", *tm - Technisches Messen* 90(7-8), pg. 418, (2023); doi:10.1515/teme-2023-0007 <https://doi.org/10.1117/1.OE.61.1.015106>