technology ■ opportunity

National Aeronautics and Space Administration
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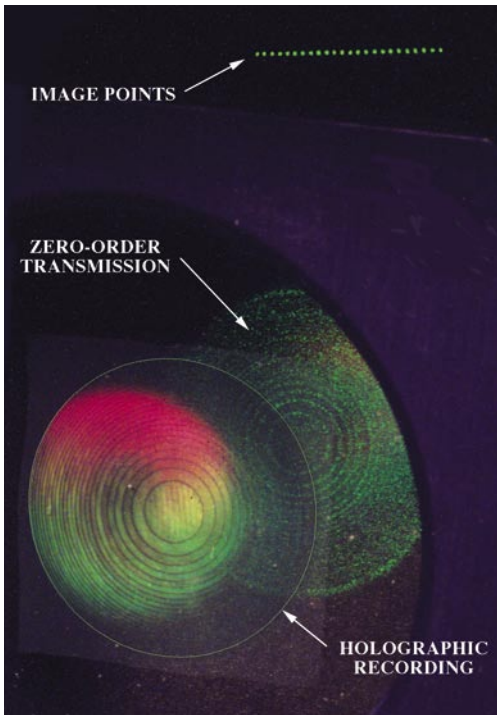
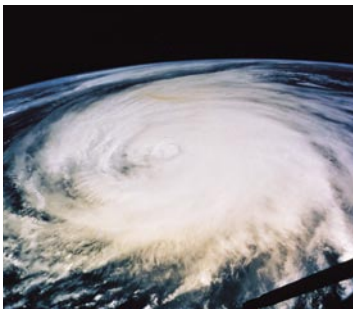
Photonics

A New Method for Spatial Image Separation

... using a Holographic Circle-to-Point Converter



The Holographic Circle-to-Point Converter is a segmented holographic optical element that images an input light beam (for example, from a Fabry-Perot interference pattern) into a series of individual points, each point corresponding to a unique segment on the optic.



NASA Goddard Space Flight Center invites companies to license its Holographic Circle-to-Point Converter. Originally developed to efficiently determine Doppler shifts using a Fabry-Perot interferometer, the circle-to-point converter can be used in applications requiring spatial or spectral separation. Potential applications range from atmospheric monitoring and meteorology to data storage and compression.

Benefits

- **Highly efficient**: Has demonstrated more than 80% transmission efficiency and produces images less than 150 microns in size
- **Reliable**: Produces no cross-talk between annuli
- **Cost-effective**: Requires no cooling devices or high-voltage wiring when used in conjunction with commercially available detectors
- **Flexible**: Accommodates any number of annuli and many sizes of holographic plates (having any radial pattern) to fit various instrument and/or measurement requirements

Applications

Goddard's technology may be useful for any application requiring the resolution of a Fabry-Perot interference pattern (e.g., spectral separation), and for applications requiring spatial separation of light beams. Specific possible applications include:

- Portable, field-deployable wind-measuring systems
- Turbulence detection
  - Airports
  - Onboard aircraft
- Meteorological forecasting
- Tracking of airborne agents on battlefields
- Spectroscopy
- Passive remote sensing
- Multiple field-of-view lidar systems
  - Measurement of multiple scattering effects for analyzing cloud and aerosol composition
- Data storage/compression
  - Can replace multiple optics for simultaneous read/write events for holographic disks

The Technology

How It Works

The Circle-to-Point Converter fills the commercial gap for a detection system capable of resolving the circular spectral distribution produced by Fabry-Perot interferometers. Resolution of the spectrum requires that the detection system consist of multiple channels that match the Fabry-Perot fringe pattern, making efficient use of the available signal. Historically, methods used to measure the output of a Fabry-Perot interferometer were large, inefficient, or required cooling or high voltages. To overcome these limitations, Goddard scientists developed a new holographic technology that allows for the use of linear, solid-state detectors. This technology resolves the circular Fabry-Perot fringe pattern and optically converts the image into a series of point images, each of which represents a specific wavelength interval. Commercially available linear, solid-state detectors are placed at the illuminated points and the intensity of light of each wavelength interval is measured independently, providing efficient measurement of the spectral shape.

Testing of the holographic plate has demonstrated greater than 80% transmission on all annuli with no cross-talk, provided that the incident light is near-collimated. The size of the image points can be less than 150 microns, and additional imaging lenses can be placed at each image point to further compress the final image size, if needed. In addition, the number and sizes of annuli and the size of the holographic plate can also be chosen to accommodate specific instruments or design requirements.

Why It Is Better

Current circular photomultiplier type detectors used to resolve the fringe pattern generated by Fabry-Perot interferometers suffer from low quantum efficiency and have long reset times between photon count events, making them unreliable and slow. They also require the additional complexity and expense of a cooling supply. In contrast, Goddard's holographic technology overcomes these challenges and is easily manufactured. It allows for the use of solid-state detectors that do not require high voltages or a cooling system, thereby minimizing system complexity.

Patents

NASA Goddard has patented this technology (U.S. Patent No. 6,313,908).

Licensing and Partnering Opportunities

This technology is part of NASA's Innovative Partnerships Program, which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to consider licensing the Holographic Circle-to-Point Converter technology (GSC-13869-1) for commercial applications.

For More Information

If you are interested in more information or want to pursue transfer of this technology (GSC-13869-1), please contact:

Office of Technology Transfer
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More information about working with NASA Goddard's Office of Technology Transfer is available online:
http://techtransfer.gsfc.nasa.gov

GSC-13869-1
12.02.05