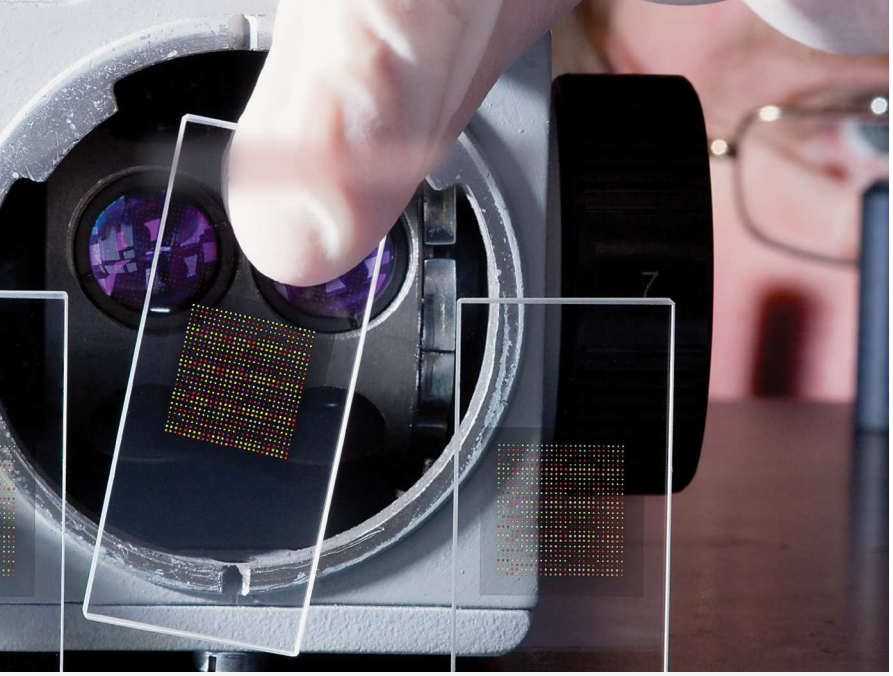

National Aeronautics and
Space Administration

technology solution

Optics

Photonic Densely Accumulated Ray-poinT

Newly discovered, interference-type laser focal point at high intensity achieved with a phase contrast approach, with or without micro zone plate lens

NASA's Langley Research Center has discovered a new approach to achieving a laser focal point size much smaller than the wavelength of light used, and smaller than that obtained using conventional micro zone plate lenses. The Photonic Densely Accumulated Ray-poinT (DART) technology relies on phase contrast along with interference phenomena, with or without the use of a micro zone plate lens. Coupled with the extremely small spot size, the technology also provides very high laser energy density at the pseudo focal point surrounded by destructive interference, thereby enabling a range of potential useful applications such as laser processing, lithography, nano fabrication, and optical data storage.

BENEFITS

- Ultra-small laser pseudo focal point, significantly smaller in size than the wavelength of the light used
- Extremely high intensity beam - power density of beyond a few MW/cm2 achievable even with a typical low power laser
- Broadly useful for range of potential applications
- Simple approach, usable with or without a micro zone plate

THE TECHNOLOGY

The NASA Photonic DART technology relies on two key aspects, one being the discovery of a new constructing interference point with an extremely fine pseudo focal point surrounded by destructive interference, using a novel phase contrast method to achieve the constructive/destructive interference. While typical micro zone plates can be used to take advantage of the newly discovered focal point, they are not necessary; a phase contrast lens can also be used. This phase contrast method is similar in effect to the micro zone plate in the creation of constructive/destructive interference, but takes advantage of phase contrast obtained though novel 3-D designs beyond the fixed binary micro zone plate design. The newly discovered central focal point in the Photonic DART technology is sharpened by the surrounding destructive interference rings present at the non-conventional focal point. The phase contrast phenomenon essentially removes the tail of the Gaussian energy distribution across the focal spot.

The NASA technology has applications in high density optical and X-ray data storage.

APPLICATIONS

The technology has several potential applications:

- High resolution optical lithography
- High density optical and X-ray data storage
- Nano fabrication
  - -- Optical nano tweezers
  - -- Nano-controlled physical and chemical reactions
  - -- Optical manipulation of molecules and nano structures
- Scientific research

PUBLICATIONS

Patent No: 8,294,989

More Information

National Aeronautics and Space Administration

The Technoloy Gateway

Langley Research Center

Mail Stop 151
Hampton, VA 23681
757.864.1178
LARC-DL-technologygateway@mail.nasa.gov

http://technology.nasa.gov/

www.nasa.gov

NP-2014-09-1224-HQ

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

LAR-17237-1