REPORT

High-Resolution Imaging by Fourier Transform X-ray Holography

IAN MCNULTY, JANOS KIRZ, CHRIS JACOBSEN, ERIK H. ANDERSON, MALCOLM R. HOWELLS, AND , DIETER P. KERN Authors Info & Affiliations

SCIENCE • 15 May 1992 • Vol 256, Issue 5059 • pp. 1009-1012 • DOI: 10.1126/science.256.5059.1009

Abstract

Fourier transform x-ray holography has been used to image gold test objects with submicrometer structure, resolving tures as small as 60 nanometers. The hologram-recording in ment uses coherent 3.4-nanometer radiation from the sof ay undulator beamline X1A at the National Synchrotron Lig ource. The specimen to be imaged is placed near the first-c focal spot produced by a Fresnel zone plate; the other ord chiefly the zeroth, illuminate the specimen. The wave scatt by the specimen interferes with the spherical reference wa om the focal spot, forming a hologram with fringes of low sp l frequency. The hologram is recorded in digital form by arge-coupled device camera, and the specimen image is obtained by numerical reconstruction.

References

ANDERSON, E, *PROCEEDINGS OF SPIE* ***1160***: 2 (1990).

GOOGLE SCHOLAR

AOKI, S, *AIP CONFERENCE PROCEEDINGS* ***147***: 49 (1986).

GOOGLE SCHOLAR

AOKI, S, X-RAY HOLOGRAPHIC MICROSCOPY, *JAPANESE JOURNAL OF APPLIED PHYSICS* ***13***: 1385 (1974).

GOOGLE SCHOLAR

BAEZ, A.V., A STUDY IN DIFFRACTION MICROSCOPY WITH SPECIAL REFERENCE TO X-RAYS, *JOURNAL OF THE OPTICAL SOCIETY OF AMERICA* ***42***: 756 (1952).

GOOGLE SCHOLAR

Brase, J., X-ray microimaging for the life sciences, *Lawrence Berkeley Laboratory Report* LBL-27660: 74 (1989).

GOOGLE SCHOLAR

Haddad, W. S., *OSA Proceedings on Short Wavelength Coherent Radiation: Generation and Applications* ***2***: 284 (1988).

GOOGLE SCHOLAR

Hertel, R., *Reference Data for Radio Engineers*: 17 (1975).

GOOGLE SCHOLAR

HOWELLS, M, *AIP CONFERENCE PROCEEDINGS* ***118***: 85 (1984).

GOOGLE SCHOLAR

HOWELLS, M, X-RAY HOLOGRAMS AT IMPROVED RESOLUTION - A STUDY OF ZYMOGEN GRANULES, *SCIENCE* ***238***: 514 (1987).

CROSSREF • GOOGLE SCHOLAR

JACOBSEN, C, *JOURNAL OF THE OPTICAL SOCIETY OF AMERICA A-OPTICS IMAGE SCIENCE AND VISION* ***7***: 1847 (1990).

GOOGLE SCHOLAR

Joyeux, D., *OSA Proceedings on Short Wavelength Coherent Radiation: Generation and Applications* ***2***: 295 (1988).

GOOGLE SCHOLAR

LATEST NEWS

NEWS | 7 APR 2022

Scientists breed honey bees to fight deadly parasite

SCIENCEINSIDER | 7 APR 2022

Kansas chemistry professor found guilty of hiding ties to China

NEWS | 7 APR 2022

News at a glance: A sobering climate alert, research beagles, and fast radio bursts

NEWS | 7 APR 2022

Mass of rare particle may conflict with 'standard model,' signaling new physics

Joyeux, D., *X-Ray Microscopy II*: 246 (1988).

GOOGLE SCHOLAR

KONDRATENKO, A.M., *OPTIKA I SPEKTROSKOPIYA* ***42***: 189 (1977).

GOOGLE SCHOLAR

Kondratenko, A., *Optical InformationProcessing* ***2***: 1 (1978).

GOOGLE SCHOLAR

MCNULTY, I, SOFT-X-RAY MICROSCOPE USING FOURIER-TRANSFORM HOLOGRAPHY, *NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH SECTION A-ACCELERATORS SPECTROMETERS DETECTORS AND ASSOCIATED EQUIPMENT* ***291***: 74 (1990).

GOOGLE SCHOLAR

MCNULTY, I, *THESIS STATE U NEW Y* (1991).

GOOGLE SCHOLAR

Michette, A., *X-Ray Microscopy III* (1992).

GOOGLE SCHOLAR

RARBACK, H, *JOURNAL OF X-RAY SCIENCE AND TECHNOLOGY* ***2***: 274 (1990).

GOOGLE SCHOLAR

REUTER, B, EXPERIMENTS WITH FOURIER-TRANSFORM HOLOGRAMS USING 4.48NM X-RAYS, *JOURNAL OF PHYSICS E-SCIENTIFIC INSTRUMENTS* ***9***: 746 (1976).

GOOGLE SCHOLAR

ROGERS, G.L., *J MICROSC* ***89***: 125 (1969).

GOOGLE SCHOLAR

SAYRE, D, POTENTIAL OPERATING REGION FOR ULTRASOFT X-RAY MICROSCOPY OF BIOLOGICAL-MATERIALS, *SCIENCE* ***196***: 1339 (1977).

CROSSREF • GOOGLE SCHOLAR

SOLEM, J. C., *JOURNAL OF THE OPTICAL SOCIETY OF AMERICA B-OPTICAL PHYSICS* ***3***: 1551 (1986).

GOOGLE SCHOLAR

SOLEM, J.C., X-RAY BIOMICROHOLOGRAPHY, *OPTICAL ENGINEERING* ***23***: 193 (1984).

GOOGLE SCHOLAR

SOLEM, J.C., MICRO-HOLOGRAPHY OF LIVING ORGANISMS, *SCIENCE* ***218***: 229 (1982).

CROSSREF • GOOGLE SCHOLAR

STROKE, G.W., LENSLESS FOURIER-TRANSFORM METHOD FOR OPTICAL HOLOGRAPHY, *APPLIED PHYSICS LETTERS* ***6***: 201 (1965).

GOOGLE SCHOLAR

STROKE, G.W., RESOLUTION-RETRIEVING COMPENSATION OF SOURCE EFFECTS BY CORRELATIVE RECONSTRUCTION IN HIGH-RESOLUTION HOLOGRAPHY, *PHYSICS LETTERS* ***18***: 274 (1965).

GOOGLE SCHOLAR

TREBES, J.E., DEMONSTRATION OF X-RAY HOLOGRAPHY WITH AN X-RAY LASER, *SCIENCE* ***238***: 517 (1987).

CROSSREF • GOOGLE SCHOLAR

WINTHROP, J.T., X-RAY MICROSCOPY BY SUCCESSIVE FOURIER TRANSFORMATION, *PHYSICS LETTERS* ***15***: 124 (1965).

GOOGLE SCHOLAR

WINTHROP, J, X-RAY MICROSCOPY BY SUCCESSIVE FOURIER TRANSFORMATION .2. AN OPTICAL ANALOGUE EXPERIMENT, *PHYSICS LETTERS* ***21***: 413 (1966).

GOOGLE SCHOLAR