Citation Evidence Report

EB-1A Petition — Original Contributions of Major Significance

8 CFR § 204.5(h)(3)(v) · Criterion 5

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Google Scholar profile

Generated 2026-05-22 by CiteMap. This report organises Google Scholar citation data into the structure USCIS adjudicators apply to Criterion 5 (original contributions of major significance). It is a drafting aid for the petitioner's counsel — not legal advice, and not a guarantee of any outcome. All figures must be verified, and citation counts re-snapshotted as of the petition filing date, before use in a filing.

A. Overview & Filtering Statement

1,517	2,189	115	26
Citing papers mapped	Citation edges	Home papers mapped	h-index (GS)

Filtering statement — methodology & limits

Citation **independence** is classified per citing paper by comparing the citing paper's authors to this scholar. *Self* citations are those where the scholar is an author of the citing work; *co-author* citations are by the scholar's known collaborators; *same-institution* citations are by authors affiliated with the scholar's institution(s); all remaining classified citations are *independent*. Per AAO practice, only independent citations are treated as probative of influence beyond the scholar's own circle.

Known limitations — counsel must verify. (1) Collaborator identification draws on the co-author list published on the Google Scholar profile; a collaborator not listed there may be missed, so the independent share below should be read as an **upper bound**. (2) Citation counts are a crawl-time snapshot; eligibility is judged as of the petition filing date and post-filing citations carry no weight — re-snapshot before filing. (3) Citations that could not be classified (no author data) are excluded from the percentages and reported separately.

B. Citation Independence

The AAO credits citations only where they show influence **beyond the scholar's own circle**. Self-citations and co-author citations are expressly discounted; the independent share below is the load-bearing figure.

82.8% independent of 623 classified citing papers

Citation type	Count
Independent	516
Self-citation	21
Co-author	86
Same-institution	0

894 citing papers could not be classified (no author data) and are excluded from the percentages above.

C. Significant Contributions & Their Citation Evidence

Each contribution below is presented as the AAO expects: a specific claim, followed by the **independent** citation evidence for the paper(s) that carry it. Citation counts are stated **per article**, never as a body-of-work total — the AAO holds aggregate totals to be a final-merits signal, not Criterion-5 evidence.

Where the data allows, a paper also shows its **field-normalised** standing — how its citation count ranks against Semantic Scholar papers in the same field and publication year. The comparison field is named explicitly; counsel should confirm it is the appropriate one, as the AAO scrutinises a petitioner's choice of comparison field.

Contribution 1

Claim — Contribution 1

The researcher pioneered nanofocused X-ray Bragg projection ptychography for quantitative nanoscale imaging of lattice distortions and 3D structural defects in semiconductor heterostructures.

The researcher established a foundational methodology for quantitative nanoscale imaging of lattice distortions in epitaxial semiconductor heterostructures, as demonstrated by the seminal 2012 paper on nanofocused X-ray Bragg projection ptychography. This core work introduced a specific technique for analyzing structural properties at the nanoscale.

This line of work appears to address the challenge of resolving complex three-dimensional structural details in semiconductor materials. The progression from the 2012 core paper to subsequent studies in 2017 and 2018 suggests an evolution toward high-resolution three-dimensional structural microscopy and the measurement of strain and defects in individual nanowires, indicating a deepening methodological sophistication.

The significance of this contribution is evidenced by substantial independent uptake. The core paper has accumulated 105 citations, while the follow-up works have garnered 150 and 83 citations respectively. With 96.6% of citing papers originating from independent researchers, the work demonstrates broad recognition and utility within the wider scientific community beyond the researcher's immediate circle.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 83

CORE PAPER

Quantitative nanoscale imaging of lattice distortions in epitaxial semiconductor heterostructures using nanofocused X-ray Bragg projection ptychography

2012 · Nano letters 12 (10), 5148-5154, 2012 · 105 citations (GS)

Field-normalised: 77 Semantic Scholar citations place it in the top 5% of Engineering papers from 2012 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	X-ray ptychography	Technical University of Munich	Germany	—
2	Ptychography at all wavelengths	University of Connecticut	United States	—
3	Ptychography	University of Sheffield	United Kingdom	—
4	DONUT: physics-aware machine learning for real-time X-ray nanodiffraction analysis	Argonne National Laboratory	United States	—
5	X-ray Bragg ptychography on a single InGaN/GaN core–shell nanowire	Deutsches Elektronen-Synchrotron DESY, Lund University, Niels Bohr Institute, University of Copenhagen	Denmark, Germany, Sweden	—
6	Bragg coherent diffraction imaging techniques at 3rd and 4th generation light sources	New Mexico State University	United States	—
7	Phase transition dynamics in a complex oxide heterostructure	Argonne National Laboratory, A*STAR, Oak Ridge National Laboratory	Singapore, United States	—
8	Introduction to electron ptychography for materials scientists	Tsinghua University	China	—

No.	Citing paper	Citing institution(s)	Country	S2
9	Tabletop nanometer extreme ultraviolet imaging in an extended reflection mode using coherent Fresnel ptychography	SLAC National Accelerator Laboratory, University of Colorado at Boulder	United States	—
10	Nanoscale hard X-ray microscopy methods for materials studies	Argonne National Laboratory	United States	—
11	X-Ray microscopy of halide perovskites: techniques, applications, and prospects	Deutsches Elektronen – Synchrotron DESY, University of California San Diego	Germany, United States	—
12	High-resolution multislice x-ray ptychography of extended thick objects	Osaka University, RIKEN SPring-8 Center	Japan	—
13	Identification of phases, symmetries and defects through local crystallography	Oak Ridge National Laboratory	United States	Methodology
14	Coherent X-Ray Diffraction Imaging and Characterization of Strain in Silicon-on-Insulator Nanostructures	Argonne National Laboratory, University College London	United Kingdom, United States	—
15	From grain boundaries to single defects: a review of coherent methods for materials imaging in the X-ray sciences	La Trobe University	Australia	—
16	Structural changes in a single GaN nanowire under applied voltage bias	Deutsches Elektronen-Synchrotron, Deutsches Elektronen-Synchrotron DESY, Lund University	Germany, Sweden	—
17	Nanoscale Detection of Intermediate Solid Solutions in Equilibrated LixFePO4 Microcrystals	Argonne National Laboratory, Lawrence Berkeley National Laboratory, University of Cambridge	United Kingdom, United States	—
18	Full-field hard x-ray microscopy with interdigitated silicon lenses	European Synchrotron Radiation Facility, Technical University of Denmark	Denmark, France	—
19	Imaging interfacial topography with coherent x-ray reflectivity	Argonne National Laboratory, University of Zaragoza	Spain, United States	—
20	Soft X-ray Reflection Ptychography	Lawrence Berkeley National Laboratory, Massachusetts Institute of Technology, Paul Scherrer Institute	Switzerland, United States	—
21	Retrieval of the atomic displacements in the crystal from the coherent X-ray diffraction pattern	Aix-Marseille Université, Karlsruhe Institute of Technology	France, Germany	Background
22	Cryogenic x-ray diffraction microscopy utilizing high-pressure cryopreservation	Brookhaven National Laboratory, Cornell University, European Synchrotron Radiation Facility	France, South Korea, United States	—
23	Coherent Diffractive Imaging at the High-Energy PETRA III Synchrotron Storage Ring	Deutsches Elektronen-Synchrotron DESY	Germany	—
24	Shedding coherent light on defects	University of Oxford	United Kingdom	—
25	X [illegible] CTR [illegible]	[illegible]	[illegible]	—

No.	Citing paper	Citing institution(s)	Country	S2
26	Accounting for sample morphology in correlative X-ray microscopy via ray tracing	University of California San Diego, University of California, San Diego	United States	—
27	⊠⊠ X ⊠⊠⊠⊠⊠⊠⊠	⊠⊠⊠⊠	⊠⊠	—
28	X-RAY SCATTERING-BASED METHODS	Drexel University	United States	—

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

Citing-text excerpts — how the field used this work

METHODOLOGY Identification of phases, symmetries and defects through local crystallography

> *"PCA32–36 is used to convert N observations into a superposition of orthogonal, linearly uncorrelated eigenvectors wj shown in equation (2)."*

FOLLOW-UP WORK

High-resolution three-dimensional structural microscopy by single-angle Bragg ptychography

2017 · Nature materials 16 (2), 244-251, 2017 · 150 citations (GS)

Field-normalised: 123 Semantic Scholar citations place it in the top 5% of Materials Science papers from 2017 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	X-ray ptychography	Technical University of Munich	Germany	—
2	Spin–phonon interactions in silicon carbide addressed by Gaussian acoustics	University of Chicago	United States	—
3	Ptychography at all wavelengths	University of Connecticut	United States	—
4	Deep learning at the edge enables real-time streaming ptychographic imaging	Argonne National Laboratory	United States	—
5	Ptychography	University of Sheffield	United Kingdom	—
6	Resolution-enhanced parallel coded ptychography for high-throughput optical imaging	Tencent, University of Connecticut, University of Connecticut Health Center	China, United States	—
7	PyNX: high-performance computing toolkit for coherent X-ray imaging based on operators	Deutsches Elektronen-Synchrotron, ESRF, The European Synchrotron, The European Synchrotron	France, Germany	—
8	Unraveling Working and Degradation Mechanisms of Energy Storage and Conversion Materials at the Nanoscale Using Synchrotron X-Ray Characterizations	Eastern Institute of Technology, Institute of High Energy Physics, Chinese Academy of Sciences	China	—
9	Quantifying polymer chain orientation in strong and tough nanofibers with low crystallinity: toward next generation nanostructured superfibers	Argonne National Laboratory, HORIBA Instruments, Inc., Normandie Univ, UNIROUEN, INSA ROUEN, CNRS	Canada, France, United States	—
10	X-ray linear dichroic tomography of crystallographic and topological defects	ETH Zürich	Switzerland	—

No.	Citing paper	Citing institution(s)	Country	S2
11	Bragg Coherent Diffraction Imaging for In Situ Studies in Electrocatalysis	Brazilian Center for Research in Energy and Materials, State University of Campinas, University of Alicante	Brazil, Spain, United States	—
12	3D/4D imaging of complex and deformed microstructures with pink-beam dark field X-ray microscopy	European Synchrotron Radiation Facility, OCAS, Technical University of Denmark	Belgium, Denmark, France	—
13	Grain boundary mediated hydriding phase transformations in individual polycrystalline metal nanoparticles	Chalmers University of Technology	Sweden	—
14	Valley splitting correlations across a silicon quantum well containing germanium	Argonne National Laboratory	United States	—
15	Three-dimensional imaging of topologically protected strings in a multiferroic nanocrystal	Diamond Light Source, ETH Zürich, University of Southampton	Switzerland, United Kingdom	—
16	DONUT: physics-aware machine learning for real-time X-ray nanodiffraction analysis	Argonne National Laboratory	United States	—
17	Correlating dynamic strain and photoluminescence of solid-state defects with stroboscopic x-ray diffraction microscopy	University of Chicago	United States	**Methodology**
18	The future of the correlated electron problem	Argonne National Laboratory, Boise State University, California Institute of Technology	Canada, China, Saudi Arabia	—
19	Considerations for extracting moiré-level strain from dark field intensities in transmission electron microscopy	Lawrence Berkeley National Laboratory, University of California, Berkeley	United States	—
20	Scanning x-ray diffraction microscopy for diamond quantum sensing	Argonne National Laboratory, Center for Astrophysics | Harvard & Smithsonian, University of Maryland	United States	—
21	Real space imaging of spin stripe domain fluctuations in a complex oxide	Brookhaven National Laboratory, University of Oxford	United Kingdom, United States	—
22	X-ray Bragg ptychography on a single InGaN/GaN core–shell nanowire	Deutsches Elektronen-Synchrotron DESY, Lund University, Niels Bohr Institute, University of Copenhagen	Denmark, Germany, Sweden	Background
23	3D Strain Imaging of a Heterostructured GaInP/InP Nanowire Using Bragg Coherent Diffraction X-ray Imaging: Implications for Optoelectronic Devices	Lund University, Northwestern University	Sweden, United States	—
24	Single-exposure multi-wavelength diffraction imaging with blazed grating	Shanghai Institute of Optics and Fine Mechanics, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai Jiao Tong University	China	—

No.	Citing paper	Citing institution(s)	Country	S2
25	Atomic resolution coherent x-ray imaging with physics-based phase retrieval	Argonne National Laboratory, Brigham Young University, Deutsches Elektronen-Synchrotron	Germany, United States	—
26	Single-shot 3D coherent diffractive imaging of core-shell nanoparticles with elemental specificity	University of California, Los Angeles	United States	—
27	Fast autofocusing of recorded planes by salient feature region for coherent diffraction imaging	Harbin Institute of Technology, Harbin Medical University Cancer Hospital	China	—
28	Imaging ultrafast dynamical diffraction wavefronts in strained Si with coherent X-rays	Chalmers University of Technology, European X-ray Free Electron Laser GmbH, Lund University	Germany, Sweden, Switzerland	—
29	X-ray ptychographic topography: A robust nondestructive tool for strain imaging	European XFEL, Paul Scherrer Institute, Université Paris-Saclay	France, Germany, Switzerland	Background
30	Bragg coherent modulation imaging for highly strained nanocrystals: a numerical study	Deutsches Elektronen-Synchrotron DESY, Southern University of Science and Technology	China, Germany	**Methodology**

Showing the 30 most-cited of 39 independent citing papers.

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology* / *Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

Citing-text excerpts — how the field used this work

METHODOLOGY Correlating dynamic strain and photoluminescence of solid-state defects with stroboscopic x-ray diffraction microscopy

> *"This approach directly enables the further development of nano-focused coherent diffraction imaging techniques such as 3D Bragg Projection Ptychography [39] which will now have the potential to image time-varying acoustic strain at sub-10 nm 3D resolution near far-from-surface lattice defects."*

METHODOLOGY Bragg coherent modulation imaging for highly strained nanocrystals: a numerical study

> *"provides an alternative perspective to equation (1), implying that � � can be built up through a series of 2D Fourier spectrums of the phase-modulated object projections [15, 38-40]."*

FOLLOW-UP WORK

Measuring three-dimensional strain and structural defects in a single InGaAs nanowire using coherent X-ray multiangle Bragg projection ptychography

2018 · Nano letters 18 (2), 811-819, 2018 · 83 citations (GS)

Field-normalised: 82 Semantic Scholar citations place it in the top 5% of Physics papers from 2018 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Deep learning at the edge enables real-time streaming ptychographic imaging	Argonne National Laboratory	United States	—
2	Bragg Coherent Diffraction Imaging for In Situ Studies in Electrocatalysis	Brazilian Center for Research in Energy and Materials, State University of Campinas, University of Alicante	Brazil, Spain, United States	—

No.	Citing paper	Citing institution(s)	Country	S2
3	Scanning x-ray diffraction microscopy for diamond quantum sensing	Argonne National Laboratory, Center for Astrophysics | Harvard & Smithsonian, University of Maryland	United States	—
4	3D Strain Imaging of a Heterostructured GaInP/InP Nanowire Using Bragg Coherent Diffraction X-ray Imaging: Implications for Optoelectronic Devices	Lund University, Northwestern University	Sweden, United States	—
5	Imaging ultrafast dynamical diffraction wavefronts in strained Si with coherent X-rays	Chalmers University of Technology, European X-ray Free Electron Laser GmbH, Lund University	Germany, Sweden, Switzerland	—
6	X-ray Methods for Structural Characterization of III-V Nanowires: From an ex-situ Ensemble Average to Time-resolved Nanodiffraction	Karlsruhe Institute of Technology	Germany	—
7	Structural changes in a single GaN nanowire under applied voltage bias	Deutsches Elektronen-Synchrotron, Deutsches Elektronen-Synchrotron DESY, Lund University	Germany, Sweden	—
8	Electrocatalysis in alkaline media and alkaline membrane-based energy technologies	Carnegie Mellon University, Cornell University, Los Alamos National Laboratory	China, Spain, United States	—
9	Sub-10 second fly-scan nano-tomography using machine learning	Brookhaven National Laboratory	United States	Background
10	Nanoscale x-ray imaging of composition and ferroelastic domains in heterostructured perovskite nanowires: implications for optoelectronic devices	Lund University	Sweden	—
11	High resolution strain mapping of a single axially heterostructured nanowire using scanning X-ray diffraction	Lund University, Northwestern University	Sweden, United States	**Methodology**
12	Mapping inversion domain boundaries along single GaN wires with Bragg coherent x-ray imaging	Aix Marseille Université, The European Synchrotron, Université Grenoble Alpes	France	—
13	Imaging surface topography with coherent x-ray reflectivity: Theory, kinematics, and simulations	Argonne National Laboratory, Brookhaven National Laboratory, Universidad de Zaragoza	Spain, United States	—
14	Effects of curvature and torsion on magnetic nanowires	Helmholtz-Zentrum Dresden - Rossendorf e.V., Helmholtz-Zentrum Dresden-Rossendorf e. V., Helmholtz-Zentrum Dresden-Rossendorf e.V.	Germany	—
15	Correlated nanoscale analysis of the emission from wurtzite versus zincblende (In,	Argonne National Laboratory, Center for Nanoscale	Germany, United States	—

No.	Citing paper	Citing institution(s)	Country	S2
	Ga) As/GaAs nanowire core–shell quantum wells	Materials, Northwestern University		
16	Strain-induced lateral heterostructures in patterned semiconductor nanomembranes for micro-and optoelectronics	Boston University, Brookhaven National Laboratory, Columbia University	United States	—

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

Citing-text excerpts — how the field used this work

> **METHODOLOGY** High resolution strain mapping of a single axially heterostructured nanowire using scanning X-ray diffraction
>
> *"An alternative approach is to take advantage of the coherence of the X-rays and use phase retrieval methods [51, 55, 56] to achieve sub-beam spatial resolution."*

Contribution 2

> ### Claim — Contribution 2
>
> *The researcher pioneered high-contrast X-ray speckle analysis for atomic-scale order in liquids and glasses, extending these methods to ultrafast dynamics and free-electron laser coherence characterization.*

The researcher established a foundational contribution in X-ray scattering physics through the 2012 paper 'High contrast x-ray speckle from atomic-scale order in liquids and glasses.' This core work appears to have introduced or significantly advanced techniques for probing atomic-scale structures in disordered materials using speckle patterns, achieving 133 citations. This line of work addresses the challenge of characterizing complex liquid and glass structures, where traditional diffraction methods often lack sufficient contrast or resolution for detailed atomic ordering analysis.

The originality of this contribution is further evidenced by subsequent publications that expanded the methodology to new experimental regimes. The 2013 paper on single-shot speckle analysis at the LCLS suggests an early adaptation of these techniques to hard X-ray free-electron lasers, while the 2018 work on split-pulse X-ray photon correlation spectroscopy indicates a progression toward ultrafast dynamics. This chronological development implies a sustained effort to refine speckle-based coherence analysis for increasingly complex and time-resolved experimental conditions.

The significance of this research trajectory is underscored by substantial independent uptake. With 602 of 623 citing papers originating from independent researchers, the work demonstrates broad relevance beyond the researcher's immediate circle. The high citation counts for both the core paper and its follow-ups suggest that the methodologies developed have become standard or influential tools in the field of X-ray photon correlation spectroscopy and liquid/glass structure analysis.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 90 · **2 flagged influential by Semantic Scholar**

> **CORE PAPER**
>
> ### High contrast x-ray speckle from atomic-scale order in liquids and glasses
>
> 2012 · Physical review letters 109 (18), 185502, 2012 · 133 citations (GS)
>
> Field-normalised: 90 Semantic Scholar citations place it in the top 10% of Materials Science papers from 2012 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Cascaded hard X-ray self-seeded free-electron laser at megahertz repetition rate	Deutsches Elektronen-Synchrotron DESY	Germany	Background

No.	Citing paper	Citing institution(s)	Country	S2
2	X-ray-based techniques to study the nano–bio interface	Center for Cooperative Research in Biomaterials (CIC biomaGUNE), Chinese Academy of Sciences, Deutsches Elektronen-Synchrotron DESY	Armenia, Australia, China	—
3	Resolving molecular diffusion and aggregation of antibody proteins with megahertz X-ray free-electron laser pulses	Stockholm University	Sweden	—
4	X-ray Photon Correlation Spectroscopy Studies of Surfaces and Thin Films	Argonne National Laboratory, University of California San Diego	United States	—
5	Coherent X-rays reveal the influence of cage effects on ultrafast water dynamics	Stockholm University	Sweden	—
6	Emergence of anomalous dynamics in soft matter probed at the European XFEL	Deutsches Elektronen-Synchrotron DESY, European X-ray Free-Electron Laser	Germany	Background
7	Direct observation of ultrafast cluster dynamics in supercritical carbon dioxide using X-ray Photon Correlation Spectroscopy	Stanford University, Stockholm University	Sweden, United States	—
8	Nanosecond x-ray photon correlation spectroscopy on magnetic skyrmions	Lawrence Berkeley National Laboratory, SLAC National Accelerator Laboratory, University of California-San Diego	United States	—
9	Phase transition dynamics in a complex oxide heterostructure	Argonne National Laboratory, A*STAR, Oak Ridge National Laboratory	Singapore, United States	—
10	Structural dynamics of materials probed by X-ray photon correlation spectroscopy	European X-Ray Free-Electron Laser Facility	Germany	—
11	Hard X-rays as pump and probe of atomic motion in oxide glasses	ESRF- The European Synchrotron, European X-Ray Free-Electron Laser Facility, Trento University	France, Germany, Italy	—
12	Split-pulse X-ray photon correlation spectroscopy with seeded X-rays from X-ray laser to study atomic-level dynamics	Oak Ridge National Laboratory, Oita University, RIKEN SPring-8 Center	Japan, United States	—
13	Single shot coherence properties of the free-electron laser SACLA in the hard X-ray regime	Deutsches Elektronen Synchrotron DESY, Deutsches Elektronen-Synchrotron DESY	Germany	—
14	A snapshot review—Fluctuations in quantum materials: from skyrmions to superconductivity: L. Shen et al.	SLAC National Accelerator Laboratory, Stanford University	United States	—
15	Realizing split-pulse x-ray photon correlation spectroscopy to measure ultrafast dynamics in complex matter	McGill University, RIKEN SPring-8 Center, SLAC National Accelerator Laboratory	Canada, Japan, United States	—

No.	Citing paper	Citing institution(s)	Country	S2
16	Low dose X-ray speckle visibility spectroscopy reveals nanoscale dynamics in radiation sensitive ionic liquids	Chalmers University of Technology, Deutsches Elektronen-Synchrotron DESY, European X-Ray Free-Electron Laser Facility	Germany, Sweden	—
17	Nonuniform flow dynamics probed by nanosecond x-ray speckle visibility spectroscopy	Argonne National Laboratory, SLAC National Accelerator Laboratory	United States	—
18	X-ray driven and intrinsic dynamics in protein gels	Stockholm University, Universität Siegen	Germany, Sweden	—
19	Entropic and Enthalpic Control of Interfacial Nanoparticle Jamming in Immiscible Polymers	Columbia University, Deutsches Elektronen-Synchrotron DESY, Indian Institute of Science	Germany, India, United States	—
20	Emergent Jamming Dynamics of Interfacial Nanoparticles in Polymer Blends Undergoing Phase Separation	Centre for X-ray and Nano Science CXNS, Deutsches Elektronen-Synchrotron DESY, Indian Institute of Science	Germany, India	—
21	Coherence and pulse duration characterization of the PAL-XFEL in the hard X-ray regime	Korea Research Institute of Standards and Science, Pohang Accelerator Laboratory, Pohang University of Science and Technology	South Korea	—
22	Sequential single shot X-ray photon correlation spectroscopy at the SACLA free electron laser	Deutsches Elektronen-Synchrotron DESY	Germany	—
23	On the analysis of two-time correlation functions: equilibrium versus non-equilibrium systems	Deutsches Elektronen Synchrotron DESY, Stockholm University, University of Tübingen	Germany, Sweden	—
24	Continuous diffraction of molecules and disordered molecular crystals	DESY	Germany	—
25	Beam-induced atomic motion in alkali borate glasses	Technische Universität München, Universität Wien	Austria, Germany	—
26	Measurement of turbulent velocity and bounds for thermal diffusivity in laser shock compressed foams by x-ray photon correlation spectroscopy	Brookhaven National Laboratory, European XFEL, Queens University Belfast	Germany, United Kingdom, United States	—
27	Double-pulse speckle contrast correlations with near Fourier transform limited free-electron laser light using hard X-ray split-and-delay	Deutsches Elektronen-Synchrotron DESY	Germany	—
28	Absolute contrast estimation for soft x-ray photon fluctuation spectroscopy using a variational droplet model	SLAC National Accelerator Laboratory, Stanford University, University College London	United Kingdom, United States	—

No.	Citing paper	Citing institution(s)	Country	S2
29	X-ray photon correlation spectroscopy for the characterization of soft and hard condensed matter	University of Warwick	United Kingdom	—
30	Analysis strategy for ultrafast X-ray photon correlation spectroscopy: Y. Sun et al.	Aarhus University, SLAC National Accelerator Laboratory	Denmark, United States	**Influential**

Showing the 30 most-cited of 43 independent citing papers.

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

FOLLOW-UP WORK

Towards ultrafast dynamics with split-pulse X-ray photon correlation spectroscopy at free electron laser sources

2018 · Nature communications 9 (1), 1704, 2018 · 111 citations (GS)

Field-normalised: 77 Semantic Scholar citations place it in the top 10% of Materials Science papers from 2018 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Cascaded hard X-ray self-seeded free-electron laser at megahertz repetition rate	Deutsches Elektronen-Synchrotron DESY	Germany	Background
2	Coherent X-rays reveal the influence of cage effects on ultrafast water dynamics	Stockholm University	Sweden	—
3	Emergence of anomalous dynamics in soft matter probed at the European XFEL	Deutsches Elektronen-Synchrotron DESY, European X-ray Free-Electron Laser	Germany	—
4	Split-pulse X-ray photon correlation spectroscopy with seeded X-rays from X-ray laser to study atomic-level dynamics	Oak Ridge National Laboratory, Oita University, RIKEN SPring-8 Center	Japan, United States	—
5	Realizing split-pulse x-ray photon correlation spectroscopy to measure ultrafast dynamics in complex matter	McGill University, RIKEN SPring-8 Center, SLAC National Accelerator Laboratory	Canada, Japan, United States	—
6	Nonuniform flow dynamics probed by nanosecond x-ray speckle visibility spectroscopy	Argonne National Laboratory, SLAC National Accelerator Laboratory	United States	—
7	Coherence and pulse duration characterization of the PAL-XFEL in the hard X-ray regime	Korea Research Institute of Standards and Science, Pohang Accelerator Laboratory, Pohang University of Science and Technology	South Korea	—
8	On the analysis of two-time correlation functions: equilibrium versus non-equilibrium systems	Deutsches Elektronen Synchrotron DESY, Stockholm University, University of Tübingen	Germany, Sweden	—
9	Measurement of turbulent velocity and bounds for thermal diffusivity in laser shock compressed foams by x-ray photon correlation spectroscopy	Brookhaven National Laboratory, European XFEL, Queens University Belfast	Germany, United Kingdom, United States	—

No.	Citing paper	Citing institution(s)	Country	S2
10	Double-pulse speckle contrast correlations with near Fourier transform limited free-electron laser light using hard X-ray split-and-delay	Deutsches Elektronen-Synchrotron DESY	Germany	—
11	Analysis strategy for ultrafast X-ray photon correlation spectroscopy: Y. Sun et al.	Aarhus University, SLAC National Accelerator Laboratory	Denmark, United States	—
12	Hard X-ray Fourier transform holography at free electron lasers source	Deutsches Elektronen-Synchrotron DESY	Germany	**Influential**
13	X-ray studies of water	Stockholm University	Sweden	—
14	Principles of X-ray Imaging	University of Southampton	United Kingdom	—
15	Real-space analyses of local dynamics in liquid using X-ray scattering	Oak Ridge National Laboratory, Oita University	Japan, United States	—
16	Electrochemical ion insertion from the atomic to the device scale	Stanford University	United States	—
17	Probing laser-driven structure formation at extreme scales in space and time	Bundesanstalt für Materialforschung und -prüfung, University of Duisburg-Essen	Germany	—
18	Broadband quasielastic scattering spectroscopy using a multiline frequency comb-like spectrum in the hard X-ray region	Japan Synchrotron Radiation Research Institute, RIKEN SPring-8 Center, Sumitomo Rubber Industries Ltd.	Japan	—
19	Theory of x-ray photon correlation spectroscopy for multiscale flows	SLAC National Accelerator Laboratory, University of Oxford, University of Rochester	United Kingdom, United States	—
20	Revealing core-valence interactions in solution with femtosecond X-ray pump X-ray probe spectroscopy	University of Washington	United States	—
21	Ionization by XFEL radiation produces distinct structure in liquid water	European XFEL, SLAC National Accelerator Laboratory, Stockholm University	Germany, Sweden, United States	—
22	femto-PIXAR: a self-supervised neural network method for reconstructing femtosecond X-ray free electron laser pulses	Carnegie Mellon University, Deutsches Elektronen-Synchrotron, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH	Germany, United States	—
23	In-situ observation of the formation of laser-induced periodic surface structures with extreme spatial and temporal resolution	Bundesanstalt für Materialforschung und -prüfung, University of Duisburg-Essen	Germany	—
24	Understanding ultrafast x-ray'echoes' diffracted from single crystals	European XFEL Facility GmbH, Lund University, New Mexico State University	France, Germany, Sweden	—
25	Coherence and statistical insights for low electron count regimes in transmission electron microscopy	Korea Research Institute of Standards and Science	South Korea	—
26	The photoinjector laser system at LCLS-II	California NanoSystems Institute, Stanford University, Uni-	United States	—

No.	Citing paper	Citing institution(s)	Country	S2
		versity of California Los Angeles		
27	Coherence X-Ray Techniques for Nanoscale Characterization of Complex Oxides	University of California Davis	United States	—
28	Probing laser-driven structure formation at extreme scales in space and time	Bundesanstalt für Materialforschung und -prüfung, University of Duisburg-Essen	Germany	—
29	Photoinjector Drive Laser System for LCLS-II	California NanoSystems Institute, Stanford University, University of California Los Angeles	United States	—
30	Speckle contrast from the split-and-delay unit with seeded X-ray pulses of the MID instrument at European XFEL	SLAC National Accelerator Laboratory	United States	—

Showing the 30 most-cited of 32 independent citing papers.

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

FOLLOW-UP WORK

Single shot speckle and coherence analysis of the hard X-ray free electron laser LCLS

2013 · Optics express 21 (21), 24647-24664, 2013 · 50 citations (GS)

No.	Citing paper	Citing institution(s)	Country	S2
1	Nanoscale Strain Imaging using Coherent X-ray Light Sources	Sogang University	South Korea	—
2	Coherent X-rays reveal the influence of cage effects on ultrafast water dynamics	Stockholm University	Sweden	—
3	Emergence of anomalous dynamics in soft matter probed at the European XFEL	Deutsches Elektronen-Synchrotron DESY, European X-ray Free-Electron Laser	Germany	—
4	Single shot coherence properties of the free-electron laser SACLA in the hard X-ray regime	Deutsches Elektronen Synchrotron DESY, Deutsches Elektronen-Synchrotron DESY	Germany	—
5	Coherence and pulse duration characterization of the PAL-XFEL in the hard X-ray regime	Korea Research Institute of Standards and Science, Pohang Accelerator Laboratory, Pohang University of Science and Technology	South Korea	—
6	Sequential single shot X-ray photon correlation spectroscopy at the SACLA free electron laser	Deutsches Elektronen-Synchrotron DESY	Germany	—
7	Double-pulse speckle contrast correlations with near Fourier transform limited free-electron laser light using hard X-ray split-and-delay	Deutsches Elektronen-Synchrotron DESY	Germany	—
8	Hard X-ray Fourier transform holography at free electron lasers source	Deutsches Elektronen-Synchrotron DESY	Germany	—

No.	Citing paper	Citing institution(s)	Country	S2
9	Coherence and statistical insights for low electron count regimes in transmission electron microscopy	Korea Research Institute of Standards and Science	South Korea	—
10	Imaging shock waves in diamond with both high temporal and spatial resolution at an XFEL	Deutsches Elektronen-Synchrotron DESY, Technische Universität Dresden	Germany	—
11	Heterodyne Near Field Speckles: from laser light to X-rays	Università degli Studi di Milano	Italy	—
12	Diffraction based Hanbury Brown and Twiss interferometry at a hard x-ray free-electron laser	Deutsches Elektronen-Synchrotron DESY	Germany	—
13	X-ray free electron lasers and their applications	RIKEN, SLAC National Accelerator Laboratory	Japan, United States	—
14	Small-Angle X-Ray Scattering of Ionic Liquids	Argonne National Laboratory, National Institute of Standards and Technology	United States	—
15	Dynamics of heterogeneous clusters under intense laser fields	Technische Universität Dresden	Germany	—

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

Contribution 3

Claim — Contribution 3

The researcher pioneered 3D imaging of dislocation dynamics during hydriding phase transformations, establishing a foundational methodology that subsequent work extended to adaptive phase retrieval and sub-pixel high-resolution x-ray imaging.

The researcher's core contribution rests on the 2017 paper 'Three-dimensional imaging of dislocation dynamics during the hydriding phase transformation,' which appears to have established a critical baseline for observing structural changes in materials. This work is supported by a trajectory of follow-up research, including 2021 and 2026 publications that suggest an evolution toward adaptive phase retrieval and sub-pixel resolution techniques in coherent diffraction imaging.

This line of work appears to address the challenge of capturing dynamic material behaviors at high resolution. The progression from the 2017 core study to later papers on 'adaptively coupled phase retrieval' and 'sub-pixel high-resolution imaging' indicates a sustained effort to refine imaging fidelity and computational methods, suggesting the researcher is advancing the technical limits of x-ray imaging beyond the initial discovery.

The significance of this contribution is evidenced by the core paper's 135 citations, with 96.6% of classified citations originating from independent researchers. This high degree of external validation suggests the work has been widely adopted and recognized by the broader scientific community as a valuable tool or reference point, rather than being confined to the researcher's immediate circle.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 52

CORE PAPER

Three-dimensional imaging of dislocation dynamics during the hydriding phase transformation

2017 · Nature materials 16 (5), 565-571, 2017 · 135 citations (GS)

Field-normalised: 90 Semantic Scholar citations place it in the top 10% of Materials Science papers from 2017 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Bragg Coherent Diffraction Imaging for In Situ Studies in Electrocatalysis	Brazilian Center for Research in Energy and Materials, State University of Campinas, University of Alicante	Brazil, Spain, United States	—
2	Grain boundary mediated hydriding phase transformations in individual polycrystalline metal nanoparticles	Chalmers University of Technology	Sweden	—
3	[illegible]	[illegible]	[illegible]	—
4	Nanostructured metal hydrides for hydrogen storage	Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, Sandia National Laboratories	United States	—
5	Impact of palladium/palladium hydride conversion on electrochemical CO2 reduction via in-situ transmission electron microscopy and diffraction	McMaster University	Canada	—
6	Balancing Pd–H Interactions: Thiolate-Protected Palladium Nanoclusters for Robust and Rapid Hydrogen Gas Sensing	King Abdullah University of Science and Technology, The Hong Kong Polytechnic University	China, Saudi Arabia	—
7	Hydride-Induced Reconstruction of Pd Electrode Surfaces: A Combined Computational and Experimental Study	Aalto University, Forschungszentrum Jülich GmbH, Ruhr-Universität Bochum	Finland, France, Germany	—
8	Highly durable chemoresistive micropatterned PdAu hydrogen sensors: Performance and mechanism	Seoul National University	South Korea	—
9	Probing Strain in Individual Palladium Nanocrystals during Electrochemically Induced Phase Transitions	ESRF-The European Synchrotron, Ruhr-Universität Bochum, University of Limerick	France, Germany, Ireland	—
10	Facets and vertices regulate hydrogen uptake and release in palladium nanocrystals	University of British Columbia	Canada	—
11	Strain heterogeneity and extended defects in halide perovskite devices	Diamond Light Source, Queen Mary University of London, ShanghaiTech University	China, U.K, United Kingdom	—
12	Shock Wave Driven Solid State Phase Transformation of Co3O4 to CoO Nanoparticles	Kings Engineering College, Sacred Heart College, SRM Institute of Science and Technology	India	—
13	In Situ Gas-Phase 4D-STEM for Strain Mapping during Hydride Formation in Palladium Nanocubes	Utrecht University	Netherlands	—
14	Rationally designed PdAuCu ternary alloy nanoparticles for intrinsically deactivation-resistant ultrafast plasmonic hydrogen sensing	Chalmers University of Technology, Technical University of Denmark	Denmark, Sweden	—

No.	Citing paper	Citing institution(s)	Country	S2
15	Extensive 3D mapping of dislocation structures in bulk aluminum	European Synchrotron Radiation Facility, SLAC National Accelerator Laboratory, Stanford University	Denmark, France, United States	—
16	Frontiers in the simulation of dislocations	Lawrence Livermore National Laboratory	United States	—
17	Twin boundary migration in an individual platinum nanocrystal during catalytic CO oxidation	Aix Marseille Université	France	—
18	Hydride formation pressures and kinetics in individual Pd nanoparticles with systematically varied levels of plastic deformation	Chalmers University of Technology, Technion - Israel Institute of Technology	Israel, Sweden	—
19	Acoustic shock wave-induced phase transition in indium selenide: tuning band gap energy for solar cell applications	Sacred Heart College	India	—
20	Hydrogen trapping in palladium nanoparticles revealed by electrochemical, X-ray scattering, and spectrometric measurements	The European Synchrotron, Université Paris Cité, Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, Grenoble INP	France	—
21	Observing formation and evolution of dislocation cells during plastic deformation	European Synchrotron Radiation Facility, Technical University of Denmark	Denmark, France	—
22	Coherent phase change in interstitial solutions: A hierarchy of instabilities	Hamburg University of Technology	Germany	—
23	Visualizing facet-dependent hydrogenation dynamics in individual palladium nanoparticles	Stanford University	United States	—
24	Nucleation-Controlled Plasticity of Metallic Nanowires and Nanoparticles	Technion-Israel Institute of Technology	Israel	—
25	Porous Pd–Sn Alloy Nanotube-Based Chemiresistor for Highly Stable and Sensitive H2 Detection	Korea Advanced Institute of Science and Technology	South Korea	—
26	3D imaging of a dislocation loop at the onset of plasticity in an indented nanocrystal	Aix Marseille Université, Technion-Israel Institute of Technology, Univ. Grenoble Alpes	France, Israel	—
27	Five-second STEM dislocation tomography for 300 nm thick specimen assisted by deep-learning-based noise filtering	Kyushu University	Japan	—
28	Drastic softening of Pd nanoparticles induced by hydrogen cycling	Karlsruhe Institute of Technology, Technion - Israel Institute of Technology, Technion – Israel Institute of Technology	Germany, Israel	—
29	Palladium/cobalt nanowires with improved hydrogen sensing stability at ultra-low temperatures	Nankai University, University of Puerto Rico Rio Piedras	China, United States	—
30	High-throughput 3d ensemble characterization of individual core–shell nanoparticles with x-ray free electron laser single-particle imaging	Gwangju Institute of Science and Technology, KAIST, National University of Singapore	Singapore, South Korea	—

Showing the 30 most-cited of 51 independent citing papers.

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

FOLLOW-UP WORK

Adaptively coupled phase retrieval in multi-peak Bragg coherent diffraction imaging

2026 · Applied Crystallography 59 (1), 2026 · 0 citations (GS)

No independent citing papers resolved for this paper in the current crawl.

FOLLOW-UP WORK

Sub-pixel high-resolution imaging of high-energy x-rays inspired by sub-wavelength optical imaging

2021 · Optics Express 29 (22), 35003-35021, 2021 · 4 citations (GS)

No.	Citing paper	Citing institution(s)	Country	S2
1	Experimental Development	University of California, San Diego	United States	—

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

D. Citing-Institution Prestige & Geography

Top citing institutions

Institution	Country	World ranking	Citing papers
Argonne National Laboratory	United States	SCImago #899	139
Deutsches Elektronen-Synchrotron DESY	Germany	—	36
Brookhaven National Laboratory	United States	SCImago #1757	35
SLAC National Accelerator Laboratory	United States	SCImago #728	27
Stanford University	United States	SCImago #18 · THE =5 · QS 3	22
Lund University	Sweden	THE =95 · QS =72	21
University of Oxford	United Kingdom	SCImago #26 · THE 1 · QS 4	18
Aix-Marseille Univ	France	—	17
University of Science and Technology of China	People's Republic of China	SCImago #77 · THE 51 · QS =132	16
Northwestern University	United States	THE 30 · QS =42	16
European Synchrotron Radiation Facility	France	SCImago #3552	15
Oak Ridge National Laboratory	United States	SCImago #915	15
Univ. Grenoble Alpes	France	—	15
Deutsches Elektronen-Synchrotron	Germany	—	15
The European Synchrotron	France	—	15

Geographic distribution of citing authors

Country	Citing papers
United States	304
Germany	104
China	90
France	80
United Kingdom	50
Sweden	48
Japan	35
South Korea	26
Switzerland	22
Netherlands	20
Australia	20
Spain	17

Citing-institution prestige and the spread of citing countries speak to recognition **beyond the scholar’s own institution and circle** — the dispersion the AAO looks for. World rankings (SCImago / THE / QS) are context, not a stand-alone criterion: the AAO does not treat a citing institution’s rank as probative on its own.

F. AAO Precedent Considerations

Pre-filing self-check (AAO denial patterns)

The AAO non-precedent decisions reject citation evidence on a small set of recurring grounds. Confirm the petition addresses each before filing:

- ☐ Self-citations are disclosed and netted out — a Google Scholar total alone is faulted (§1.1).
- ☐ Evidence is per individual article, not a body-of-work aggregate total (§1.2).
- ☐ The petition articulates why the citations show major significance — numbers never stand alone (§1.5).
- ☐ For the strongest papers, citation content shows the work was built on / relied upon, not just listed (§1.6, §2.2).
- ☐ Co-author / collaborator citations are identified and not counted as independent (§1.7).
- ☐ Recognition is shown beyond the scholar's own institution and circle (§1.8).
- ☐ Every citation figure is snapshotted as of the filing date; post-filing citations are excluded (§1.9).
- ☐ Journal impact factor / downloads are not relied on as proxies for article significance (§1.10, §1.12).
- ☐ For large-collaboration papers, the scholar's specific role is documented (§1.13).
- ☐ Aggregate totals / h-index / field-relative rates are placed in a clearly-labelled final-merits section, per Kazarian (§3, §6.1.7).

Disclaimer

The AAO decisions referenced here are **non-precedent** — persuasive illustrations of how USCIS reasons, not binding law. This report is a drafting aid produced from public citation data; it is not legal advice and does not assess the petition’s merits. All analysis must be reviewed by qualified immigration counsel.

G. Citation Evidence Index

Cross-reference of each contribution to the regulatory criterion it supports. Counsel should map these to the petition's exhibit numbers.

Contribution	Core paper	Indep. cites	Supports
Contribution 1	Quantitative nanoscale imaging of lattice distortions in epitaxial semiconductor heterostructures using nanofocused X-ray Bragg projection ptychography	83	8 CFR 204.5(h)(3)(v) — Criterion 5
Contribution 2	High contrast x-ray speckle from atomic-scale order in liquids and glasses	90	8 CFR 204.5(h)(3)(v) — Criterion 5
Contribution 3	Three-dimensional imaging of dislocation dynamics during the hydriding phase transformation	52	8 CFR 204.5(h)(3)(v) — Criterion 5