

## School of Physical Sciences Seminar

**Talk title:** Generation, Detection and Application of Twisted Waves of Light and Neutrons

**Speaker:** Prof. Charles W. Clark, Joint Quantum Institute, National Institute of Standards and Technology and University of Maryland

**Venue:** N115

**Date:** Tuesday 28th February at 11am

### Abstract:

It was about 50 years ago today, when “Dislocations in wave trains” [1] came into play. Twenty years on, “Dislocations” became a 90’s hit following the ingenious experiments of Soskin et al. [2], that showed the promise of applications of twisted or structured light with non-vanishing orbital angular momentum about its propagation axis. [3-5] Modern use cases for such modalities include increased communication bandwidth for 6G applications.[6] Quantum particle beams can also be shaped by analogue tools of optics. I shall present recent results for neutrons, made possible by microfabricated synthetic holograms containing millions of forked dislocation gratings of the type envisaged by Soskin, et al. [7]

[1] “Dislocations in wave trains,” J. F. Nye and M. V. Berry, received 17 January 1973, published in Proc. Roy. Soc. Lond. A 366 , 165 – 190 (1974)

[2] “A tribute to Marat Soskin,” M. V. Berry, et al., J. Opt. 23, 050201 (2021)

[3] “Roadmap on structured waves,” K. Bliokh, et al., arXiv:2301.05349 (submitted 13 January 2023)

[4] “Roadmap on structured light,” H. Rubinsztein-Dunlop, et al., J. Opt. 19, 013001 (2017)

[5] “Optical orbital angular momentum,” S. M. Barnett, M. Babiker and M. J. Padgett, Phil. Trans. Roy. Soc. A 375 , 20150444 (2017)

[6] “Utilizing multiplexing of structured THz beams carrying orbital-angular-momentum for high-capacity communications,” H. Zhou, et al., Optics Express 30, 25418 (2022)

[7] “Experimental realization of neutron helical waves,” D. Sarenac, M. E. Henderson, H. Ekinci, C. W. Clark, D. G. Cory, L. DeBeer-Schmitt, M. G. Huber, C. Kapahi, D. A. Pushin, Sci. Adv. 8, eadd2002 (18 November 2022)

### Bio.:

#### Education:

Ph.D., Physics, University of Chicago, 1979 (Supervisor Ugo Fano).

B.A. (honors), Mathematics and Physics, magna cum laude

Western Washington University, 1974

**Employment:**

NIST Fellow (2010 - present)

Fellow - Joint Quantum Institute (2017 - present)

NIST Co-Director, Joint Quantum Institute (2011-2016)

Chief of the NIST Electron and Optical Physics Division, 1990-2010

**Awards:**

Fellow, American Association for the Advancement of Science (2001)

Fellow, Institute of Physics (1999)

Fellow, Optical Society of America (1994)

Fellow, American Physical Society (1992)

**Professional:**

Editor NIST Digital Library of Mathematical Functions (1998 – present)

Past Chair (2010 & 2011), Physics Section, American Association for the Advancement of Science

Past Chair (2005 & 2006) Division of Atomic, Molecular, and Optical Physics, American Physical Society

**Honorary positions:**

Visiting Scholar, Merton College, University of Oxford (2023, 2019 and 2017)

Visiting Scholar, National University of Singapore (2007 – 2019)

Distinguished Visiting Professor of Quantum Physics, University of Malaya (2013 – 2015)

Adjunct Professor, Australian National University (2012 – 2014)