Improving the degree of coherence using X-ray interferometry

Yasaman Y. SIGARI, PhD-Candidate

yay921@usask.ca

April 24th, 2025 14:00

Supervisor: Dr. Mark J. BOLAND, University of Saskatchewan
Dr. Johannes M. VOGT, Canadian Light Source

Abstract

Double-slit interferometry–used as a high-precision angular resolution detector–can detect sub-micrometer spatial variations. This technique is employed at the Canadian Light Source (CLS) to measure the spatial degree of coherence of synchrotron radiation at the Brockhouse IVU beamline. This study demonstrates that the vertical spatial degree of coherence can be enhanced by reducing the vertical beam size using a set of skew quadrupoles in the storage ring.

This improvement was supported by beam size measurements at the XSR diagnostic beamline, as well as by modifying the vertical beam size using two sets of slits acting as secondary sources. Additionally, simulations using the Accelerator Toolbox model of the storage ring–with fitted linear optics obtained via the Linear Optics from Closed Orbit (LOCO) beam-based measurement algorithm–confirmed the results.

The changes in secondary source sizes are consistent with the predictions of the van Cittert–Zernike theorem, and the LOCO analysis verifies the reduction in vertical beam size at the synchrotron radiation source point. These findings provide a viable method for improving the overall beam quality in a third generation light source.

Biography

Education : Earned a B.Sc. and M.Sc. in Physics from Ferdowsi University of Mashhad, Iran, with a background in theoretical physics working on quantum field theory and subatomic particles. Moved to Canada in 2019 to join Dr.Boland's research group. PhD research focused on "Measuring and controlling the degree of coherence using X-ray interferometry". Recipient of several awards, including the Fellowship Award, HARTZ Award, and two DAPI Best Poster Presentation Awards in the Canadian Association of Physicists (CAP).