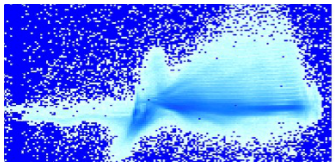

COHERENCE 2024
11th International Conference
on Phase Retrieval
and Coherent Scattering

MAX IV

Contribution ID: **22** Type: **Invited speaker**

Harnessing coherence in femtosecond fluorescence for photon diagnostics and future X-ray sources

Tuesday, 18 June 2024 11:05 (30 minutes)

This talk will focus on coherence properties of femtosecond fluorescence produced by pumping the transition metal elements with X-ray free-electron laser (XFEL) pulses.

When the intensity of the incident beam is sufficiently low, the fluorescence will be incoherent light. The higher-order coherence of such incoherent light, especially intensity correlation between separated positions, provides rich information about the incident pulses, such as pulse duration and shape [1,2], as well as beam size on the target [3]. In the first half of my talk, I will discuss spatiotemporal diagnostics of XFEL pulses using fluorescence and their advantages over existing techniques while presenting the results obtained at SPring-8 Angstrom Compact free-electron LAser (SACLA) [4-6].

When the pump intensity is sufficiently strong to induce population inversion between inner-shell states (e.g., 1s and 2p states), the fluorescence photons become collective and exhibit directionality [7]. This coherent radiation, known as amplified spontaneous emission, can serve as the basis for an X-ray laser oscillator that generates fully coherent pulses by combining with cavity optics [8]. In the second half of my talk, I will talk about the coherence properties of amplified spontaneous emission. Based on the experimental results at SACLA and theoretical simulation, I will discuss the feasibility of an X-ray laser oscillator and requirement for X-ray optics.

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[7] H. Yoneda et al., Nature 524, 446 (2015).
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Session Classification: Instrumentation and method development - S1