

# Multiple-wavelength superfluorescence/superradiance in helium following free-electron-laser excitation

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**Abstract:** *We describe experiments and simulations performed to study the production of superfluorescence pulses at visible wavelengths following the excitation of helium atoms using 30 fs, 5 mJ pulses from the SCSS extreme-ultra-violet free-electron laser.*

Superradiance is a fundamental effect which can occur when ultrafast, intense radiation is used to excite dense atomic samples. Its development is sensitive to the spectral and coherence properties of the incident radiation, and as such is an excellent test of our understanding of these properties – a characteristic particularly relevant when the excitation source is a SASE free-electron laser.

Following the observation of superfluorescence pulses at 502 nm (1s3p-1s2s) following excitation of helium at 53.7 nm [1], in further experiments using excitation at 53.7 nm and 52.2 nm [2,3] we also observed superfluorescence at 668 nm and 728 nm (1s3d-1s2p and 1s3s-1s2p). Detailed simulations have been performed to understand these results [4,5].

Prospects for experiments at SPring-8's new SACLA BL1 (wavelengths of 30 nm to 50 nm) will also be presented.

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