

**Tuesday, 6<sup>th</sup> October 2020, 13:00**  
Zoom Meeting

## **Claudio Masciovecchio**

Eletra Sincrotrone Trieste, Italy

### **New research opportunities with FELs**

I will discuss how recent advances in the performance of the FELs allowed non-linear experiments at sub-optical wavelengths. In particular Second Harmonic Generation (SHG) [1] and Transient Grating (TG) [2] experiments have finally demonstrated the high potential of VUV/soft X-ray wave mixing techniques. SHG is one of the second order non-linear responses of systems that are non-zero only for non-centrosymmetric materials as surfaces or interfaces. The advantages of using electronic resonance would imply a significantly higher surface specificity than existing soft X-ray methods [1]. TG experiments at sub-optical wavelength are relevant for the study of nanoscale dynamics in disordered systems as well as in semiconductors. Exciting phonon modes with nanometer wavelength would allow shedding light on a plethora of scientific open problems ranging from the thermal anomalies in glasses to understanding nanoscale thermal transport. Indeed the study of thermal transport approaching the nanometer is extremely important and motivated by relevant technological needs such as thermal management of electronic devices [3]. Wave mixing in the soft X-ray can be used as well to investigate drug/target intermolecular vibrational dynamics, possessing the potential to understand the marked differences in biological activities of enantiomers, or easily follow the dynamic of metal complexes [4].

[1] R. K. Lam, et al., Phys. Rev. Lett. vol. 120, pp. 023901 January 2018.

[2] F. Bencivenga et al., Adv. In Phys., vol. 63, pp. 327, May 2015.

[3] F. Bencivenga et al., Science Adv. vol. 5, pp. 5805, July 2019.

[4] R. Mincigrucci et al., submitted

**Host: Sakura Pascarelli**

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