Dynamics of resonant X-ray scattering for modern applications

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I will present an overview of both experimental and theoretical results in the field of resonant scattering of tunable soft X-ray radiation, with a main focus on the role of nuclear dynamics in resonant inelastic X-ray scattering (RIXS). I will start with a brief overview of fundamental aspects of RIXS, which will be later illustrated for different systems, giving a detailed analysis of case studies with increasing complexity, considering both gas phase and condensed matter (liquid and solid) applications. I will outline the most important achievements in investigations of coupled electron-nuclear dynamics and structural aspects in studies of liquids and solids, following our recent works [1-3]. Finally, new achievements in time-resolved studies based on X-ray free-electron lasers (XFEL) and various pump-probe techniques will be briefly discussed.

1. R. C. Couto *et al.*, *Scientific Reports* **6**, 20947, 2016.
2. R. C. Couto *et al.*, *Nat. Commun.* **8**, 12725, 2017.
3. V. Vaz da Cruz *et al.*, *Nat. Commun.* **10**, 1013, 2019.