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X-ray quantum optics with Mössbauer nuclei

Ideas from quantum optics based on coherence and interference have proven extremely successful for the study and manipulation of atoms and molecules. Recent improvements in existing and upcoming x-ray light sources prompt the question, whether such techniques could also be applied in the hard x-ray regime. This would not only be essential for fully exploiting the potential of the new machines, but could also pave the way for new applications. In turn, x-ray quantum optics could also evolve into a promising new platform for the study of light-matter interactions.

In this talk, I will review the development of quantum optics with hard x-rays, and then discuss our recent theoretical and experimental progress. I will in particular focus on experiments which involve the measurement and control of the x-ray phase, which is an important challenge in x-ray science.