

direction towards the second interaction stage to generate hard X-ray or up-shifted radiation. First experimental evidence is supplied by generation of Cu K-shell flashes in new set-up.

### **Random perturbations in the nonlocal nonlinear Schrodinger equation**

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We consider the interplay between nonlocal nonlinearity and randomness in the nonlinear Schrodinger equation. By means of both numerical simulations and analytical estimates we show that the stability of bright solitons in the presence of random perturbations increases dramatically with the nonlocality-induced finite correlation length of the noise in the transverse plane. We characterize soliton stability using two different criteria based on the evolution of the Hamiltonian and the soliton power. For the physically relevant case of weakly correlated noise we derive a simplified mean field approach which allows us to calculate the power loss analytically.

### **Plasmon-assisted high harmonic generation in vicinity of metal nanostructures**

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We develop a theory of high harmonic generation enabled by plasmonic field enhancement in a vicinity of metal nanoparticles. The theory accounts for the changes in the harmonic spectrum due to the field inhomogeneity and collisions of electrons with the metallic surface. The possibilities to use this technique for generation of single attosecond pulses, high harmonic generation in the vicinity of random surfaces, as well as high harmonic generation in gas-nanoparticle mixtures are also studied.

### **Generalization of the all-optical Kerr effect in gases and wide bandgap solids**

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We present our recent results related to the controversy on the all-optical Kerr effect and the actual intensity dependence of the nonlinear refractive index. Using a Kramers-Kronig type relation between nonlinear refraction and absorption enables us to calculate the nonlinear refraction coefficients of noble gases and wide bandgap solids, which is in remarkable agreement with literature values for the lowest order coefficient  $n_2$ . In addition, we point out the importance of ab-initio numerical methods and possible approaches to obtain conclusive results on the current debate.