The manipulation of magnetism by ultrashort laser pulses is a fundamentally challenging research area with a potentially high impact for energy efficient data storage. In ferrimagnets, fs-laser induced switching appears to go via a highly non-equilibrium state, exploiting the antiferromagnetic exchange interaction between sub-lattices. Fs-X-ray experiments and atomistic simulations reveal the importance of nanoscale chemical and magnetic inhomogeneities for non-local transfer of angular momentum.