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Theory of x-ray diffraction from laser-aligned molecules[1] PHAY HO, ROBIN SANTRA, Argonne National Laboratory — We present the theory of x-ray diffraction from an ensemble of symmetric-top molecules aligned by a short intense optical laser pulse at finite rotational temperature. Employing quantum electrodynamics, we describe the x-ray/molecule interaction as an electronically elastic one-photon scattering process. We treat the short x-ray pulse as a multi-mode radiation field and examine the effect of its coherence properties. In the practically important case that the x-ray pulse is quasi-monochromatic and its coherence time is much shorter than the time scale of molecular rotational dynamics in the laser field, there is a simple connection between the rotational wave-packet dynamics and the diffraction pattern obtained. Our theory thus opens up a new perspective for quantum molecular imaging using x-ray radiation. An illustrative application to Br_2 will be presented.

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