

# THEORY OF X-RAY DIFFRACTION BY LASER- ALIGNED MOLECULES

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## INTRODUCTION

We present a theory of x-ray diffraction from an ensemble of symmetric-top molecules aligned by a short intense optical laser pulse at finite rotational temperature.

## METHOD

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.

## RESULTS

Our theory thus opens up a new perspective for quantum molecular imaging using x-ray radiation. An illustrative application to Br<sub>2</sub> is presented.

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