LETTER

Dynamics of induced optical torque via optical vortex light

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Published 18 April 2024 • © 2024 Astro Ltd

Laser Physics Letters, Volume 21, Number 6

Citation Sh Askar *et al* 2024 *Laser Phys. Lett.* **21** 065203

DOI 10.1088/1612-202X/ad3cbf

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1. Received 14 March 2024
2. Accepted 4 April 2024
3. Published 18 April 2024

Abstract

This paper investigates the dynamics of induced torque in Nitrogen-Vacancy (NV) centers interacting with two weak optical vortex beams as well as a strong control field, exploring the impact of different system parameters such as control field intensity, detuning, magnetic field, and vortex beam strength. We find a dispersive torque behavior, indicating the sensitivity of NV centers to control parameters. Magnetic field induces level splitting, leading to a transformative effect on torque, with notable enhancements observed at specific intensities. Additionally, non-resonant torque is explored, demonstrating the controllability of torque peaks through magnetic field manipulation. Unequal strengths of vortex beams is found to yield substantial enhancements in torque. These results provide crucial insights into the induced torque dynamics in NV centers, presenting opportunities for optimized torque-based applications in quantum systems.

A correction was made to this article on 5 June 2024. A co-author name was corrected.

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