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Probing oscillation between visible photon and dark photon by optical time-domain reflectometry

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Dark photons, which can kinetically mix with ordinary photons, represent the simplest extension to the standard model. Detecting their oscillations with visible photons could provide crucial insights into the nature of dark matter and fundamental interactions beyond the standard model. We propose a novel laboratory-based approach to detect dark photon oscillations using a laser in an Optical Time-domai Reflectometry (OTDR) setup. The laser light propagating through the optical fiber undergoes oscillations with the dark photon, leading to measurable changes in the power flow. These oscillations can be precisely measured, leveraging its high sensitivity and efficiency in detecting small variations in the optical signal. This approach could provide a new avenue for probing dark photon oscillations in the laboratory and greatly improve the current experimental sensitivity to dark photon in a wide mass range.

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