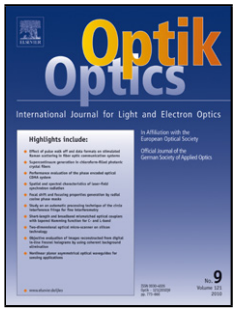
Accepted Manuscript



Title: Absorption of spin from an electromagnetic wave

Author: Radi I. Khrapko

PII: S0030-4026(17)31301-3
DOI: https://doi.org/10.1016/j.ijleo.2017.10.088
Reference: IJLEO 59824

To appear in:

Received date: 26-7-2017
Accepted date: 18-10-2017

Please cite this article as: Radi I.Khrapko, Absorption of spin from an electromagnetic wave, Optik - International Journal for Light and Electron Optics https://doi.org/10.1016/j.ijleo.2017.10.088

Absorption of spin from an electromagnetic wave

Radi I. Khrapko[1]

Moscow Aviation Institute - Volokolamskoe shosse 4, 125993 Moscow, Russia

We demonstrate the transfer of momentum, energy, and spin from a plane circularly polarized electromagnetic wave into an absorber. Lorentz transformations are used for the flux densities because a moving absorber is considered. The given calculations show that spin is the same natural property of a plane electromagnetic wave, as energy and momentum.

Key Words: classical spin; circular polarization; spin tensor

PACS 75.10.Hk

1. Introduction

It was suggested as early as 1899 by Sadowsky [1] and as 1909 by Poynting [2], that any circularly polarized light carries angular momentum volume *density*, which is proportional to the energy volume density. That is the angular momentum density and the angular momentum flux density are present in any point of the light.

> **J.H. Poynting:** If we put E for the energy in unit volume and G for the torque per unit area, we have $G = E\lambda / 2\pi$ [2].

Accordingly, some textbooks point that an infinite plane circularly polarized electromagnetic wave carries energy, momentum, and angular momentum:

> **F.S. Crawford, Jr**.: "A circularly polarized travelling plane wave carries angular momentum" [3, p. 365].

[1] Email: khrapko_ri@hotmail.com, http://khrapkori.wmsite.ru