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Cover Letter

I have used your review of Spin Tensor of Electromagnetic Waves Aug 29, 2008 Sep 23, 2008

Circularly polarized light causes shear stress

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Abstract
It is shown that, in defiance of the conventional point of view, circularly polarized light causes shear stress

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Key words: Electrodynamics spin; circular polarization; torque

Circularly polarized light carries spin. So it exerts a torque on an absorbing surface. But, according to a conventional point of view [1-5], the light wave produces tangent forces on the surface only on the periphery of the wave, and there is no mechanical stress in the central illuminated zone of the surface (except light pressure). The standard reasoning is as follows. The absorption of spin angular momentum can be thought of as a couple acting on a small area of the absorbing surface from the light. If there are many such areas, adjacent to each other, the forces acting an adjacent area elements cancel where these areas touch, and the net force acting on the combined area elements is simply the force that acts along the periphery; thus a couple acts on the periphery, but no net couple acts within the interior area.

However, a mistake is here. Any area of the surface experiences a torque from the light. The concept of forces acting from light is wrong (except light pressure). But the equilibrium of the area requires tangential forces acting along the perimeter of the area. (By the way, if the area is a disk of radius r, and the flux density of spin is γ, then the linear density of the force, $f = \gamma/2$, is independent of r and can be found from $\gamma\pi r^2 = f 2\pi r r$). Light, which illuminates adjacent area elements, cannot provide such force density. This light even does not touch the area under consideration. So, a mechanical shear stress of the surface is the only possibility to provide perimeter of the area with the need force density. This is that must be proved here. See details in [6].

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