

Photon Drag and Radiation Momentum

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The photon drag effect is the generation of an electric field in a semiconductor material by the mechanical action of an incident ray of light. An experiment by Gibson *et al* [1], showed that the photon-drag coefficient is directly proportional to the refractive index of the semiconductor. Apart from the intrinsic value of delineating the photon drag effect, [1] has the distinction of being the only experiment to date – although performed over twenty years ago – which measures directly the photon momentum density. Gibson *et al* asserted that only the Minkowski [2], expression for the radiation momentum-density, as opposed to the momentum expressions found in the theories proposed by Abraham [3], and by Peierls [4] correctly described the experimental result.

We show that although one may correctly claim that the results of the photon-drag experiment are consistent with the Minkowski momentum, to suggest that the corollary is also true, in the sense that all other momenta must necessarily be inconsistent with the experimental findings, is invalid. In short, *any* representation of the radiation momentum density is consistent with the observed value of the photon-drag coefficient.

References

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