Conservation of Energy in Coherent Backscattering of Light

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Abstract

Problem: The phenomenon of coherent backscattering (CBS) of light is an interference effect observed when light propagates in disordered media in the presence of a boundary interface (1). The common theoretical description entails violation of the law of conservation of total energy (2). [1]

Solution: We analyze in detail the processes at the origin of CBS 3 as well as their relation to the mechanism that gives rise to the effect of weak localization 4. In the frame of a full description treating jointly these effects, we provide an explanation of the mechanism ensuring energy conservation [5]. [2]



Setup

- Propagation of wave G in random media
- Description of interference effects between G, G* on disorder average
- System parameters:
- Wavenumber k
- Mean free path ℓ
- disorder strength $1/k\ell$

- (1)The CBS peak
- Experiment:
- irradiate with light
- detect backscattered intensity
- Distribution received: sharp cone centered around backscattering angle $\vartheta = 0$
- Explanation:
- Two scattering processes survive disorder average:



Which are the scattering processes to cancel the crossed contribution (H_A)

3 Analysis of different Scattering Scenarios • Influence of one additional scattering event: H_B + cc.

(4)CBS & Weak Localization: Cancelling Mechanism

 Weak Localization (WL): Loops (propagation processes

