Quantum decoherence electromagnetic shielding factor

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Abstract

In my previous research, I proposed that a conducting surface acts as a positive detector-observer in a double-slit setup, depending on its conductivity. In this study, I posit that this positive detector-observer surface simultaneously performs electromagnetic (EM) shielding. This is based on the reduction in the wave function—specifically, the transition from wave form to particle form—which decreases the amount of EM waves entering the system.

Introduction

With the rapid advancement of technology, its harmful side effects are also increasing. Among these are electromagnetic (EM) radiation pollution and Radar Absorbent Material (RAM) detection issues. There are three primary mechanisms for protection from EM radiation: reflection, absorption, and multiple reflections. While metals are traditionally used as excellent reflectors in primitive technologies, the reflection mechanism causes secondary EM radiation pollution. Consequently, absorption-dominant EM shielding materials, such as Conductive Polymer Composites (CPCs), are preferred and extensively produced today.

Hypothesis and Theoretical Framework

This study elaborates on the hypothesis[1] that quantum duality provides an additional contribution to EM shielding. In a double-slit experiment, a photon passing through the slits induces a structure on the slit walls. By transferring energy to the environment via these induced photons, the path of the original photon can be determined, causing the system to undergo decoherence without direct intervention.

The transformation of a portion of the decohered wave function into a particle form causes the quantum state of the system to become partially classical. This is a critical distinction: while a photon in a wave state might "leak" through or bypass a surface, a photon in a classicalized particle state will either penetrate the surface or be reflected/scattered. From the perspective of the shield's event horizon, this reduction in the quantum wave form can be interpreted as EM shielding. Thus, the shift toward the particle form within wave-particle duality provides an extra EM shielding contribution[2].

Calculations and Findings

The quantum contribution to shielding effectiveness (SE_{kkp}), representing the system's behavior change due to wave function decoherence, is formulated as follows:

$$SE_{kkp} = 10 \cdot \exp\left(-\log(R \cdot (1 - \Delta D))\right) \tag{1}$$

The total EM Shielding Effectiveness (SE_{Total}) is derived from the sum of traditional components and the quantum contribution:

$$EM\,SE_{Total} = EM\,SE_R + EM\,SE_A + EM\,SE_{kkp} \quad (2)$$

S1 Model Analysis

Calculations were performed for the S1 model based on literature data (at approximately 9.6 GHz):

- Initial Shielding ($EM\,SE$): 35.14 dB
- Conductivity (σ): 0.44 S/m
- S1 Model (Aperture model): $EM\,SE = 50.71$ dB
- Parameters: $R = 0.6805, A = 0.39995, \sigma = 99.61$ S/m, $\delta = 0.00524$ m
- $\Delta D = 9.348717$
- Calculated Quantum Contribution (SE_{kkp}): 15.031 dB

When the calculated quantum contribution is added to the initial composite shielding value: $35.14 + 15.031 = 50.17$ dB.

This calculated value of 50.17 dB is remarkably close to the 50.71 dB reported in the literature for the S1 model. The marginal difference is attributed to the wave propagation length.

Comparative Analysis

The following table summarizes the quantum contribution across different models:

Table 1: Comparison of different models and Quantum SE contributions.

Model	$EM\,SE$ (dB)	R	σ (S/m)	$EM\,SE_{kkp}$ (dB)
S1	50.71	0.6805	0.961	15.031
S2	66.39	0.6	1 - 1.5	27.9267
S3	70.86	0.5	1.1 - 1.25	28.92
S4	75.19	0.92075	1.483	21.6201

Conclusion and Discussion

The data demonstrates that the observed increase in EM shielding can be explained by the transition in the wave function. Comparing the experimental value of 50.71 dB with the calculated value of 50.17 dB validates the hypothesis. Consequently, the statement that quantum decoherence acts as an additional EM shielding mechanism is consistent with these findings.

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thebibliography

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