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Quantum Phase-based Plasmonic Biosensing for Enhanced COVID-19 Detection

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The COVID-19 pandemic has highlighted the urgent need for rapid and sensitive diagnostic tools to enable effective monitoring and control of the disease. In this study, we present an approach to COVID-19 detection by employing quantum phase-based surface plasmon resonance biosensing, which improves the limit of detection (LOD) compared to its classical equivalent. We demonstrate a theoretical framework of a quantum plasmonic biosensor, designed to target the SARS-CoV-2 spike protein with high specificity. In this work we will model and simulate the operation of the biosensor in an ideal noiseless setup as well as in a noisy setup which more realistically resembles the conditions in a lab. Our sensor exploits the advantages of quantum phase sensitivity and surface plasmon resonance to achieve precision level below the shot noise limit. The results show that our quantum plasmonic biosensor outperforms classical counterparts in terms of LOD, offering rapid and precise identification of viral presence at very low concentrations. This work has the potential to lead to more precise optical diagnostic devices and pave the way for more effective public health strategies in combating future pandemics.

Apply to be considered for a student ; award (Yes / No)?

No

Level for award;(Hons, MSc, PhD, N/A)?

N/A

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