Utilizing atomic wavepacket shaping for resisting the Casimir-Polder force

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Bohmian mechanics has been designed to give rise to identical predictions of those derived by standard quantum mechanics, while invoking an interesting interpretation of it – one which allows the classical notion of a particle to be maintained alongside with a guiding wave. For this, the Bohmian model makes use of a unique quantum potential which governs the trajectory of the particle. At times, these Bohmian trajectories go against our common sense and have thus been called surrealistic. Nevertheless, they have been observed experimentally. In this work we show that this surrealistic interpretation of standard quantum theory is not only helpful if one wants to retain the notion of a particle, but may also lead to the engineering of new phenomena. Specifically, we demonstrate how the fundamental Casimir-Polder force, by which atoms are attracted to a surface and eventually stick to it, may be temporarily suppressed by utilizing a specially designed quantum potential. We show that when harnessing the quantum potential via a suitable atomic beam shaping, the absorption by the surface is reduced. This is proven both analytically and numerically. All these may enable new insights into Bohmian mechanics as well as new applications to metrology and sensing.