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Extracting CP violation and strong phase in D decays by using quantum correlations in $\psi(3770) \rightarrow D^0 D^0\bar{0}$ and $\psi(3770) \rightarrow D^0 D^0\bar{0} \rightarrow (V_1 V_2)(K \pi)$

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The charm quark offers interesting opportunities to cross-check the mechanism of CP violation precisely tested in the strange and beauty sectors. In this paper, we exploit the angular and quantum correlations in the $D \bar{D}$ pairs produced through the decay of the $\psi(3770)$ resonance in a charm factory to investigate CP-violation in two different ways. We build CP-violating observables in $\psi(3770) \rightarrow D \bar{D} \rightarrow (V_1 V_2)(V_3 V_4)$ to isolate specific New Physics effects in the charm sector. We also consider the case of $\psi(3770) \rightarrow D \bar{D} \rightarrow (V_1 V_2)(K \pi)$ decays, which provide a new way to measure the strong phase difference δ between Cabibbo-favoured and doubly-Cabibbo suppressed D decays required in the determination of the CKM angle γ . Neglecting the systematics, we give a first rough estimate of the sensitivities of these measurements at BES-III with an integrated luminosity of 20 fb^{-1} at $\psi(3770)$ peak and at a future Super tau-charm factory with a luminosity of $10^{35} \text{ cm}^{-2} \text{ s}^{-1}$.

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