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A triple Z' signal via light scalar boson in Z-factories

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In this talk, we discuss triple Z' boson signals via the decay chain of $Z \to Z'\phi \to Z'Z'Z'$, with a new light scalar ϕ, at future Z factories such as CEPC and FCC-ee. These new bosons ϕ and Z' naturally appear in models with a new $U(1)$ gauge symmetry which is spontaneously broken and introduced in various new physics scenarios. The branching ratio of $Z \to Z'\phi \to Z'Z'Z'$ can be larger than 10^{-12}, which gives $O(1)$ events at Tera-Z experiments, when a product of g_X (new gauge coupling) and ζ (Z-Z' mixing) is larger than around 10^{-6}. We find that the search for $Z \to Z'Z'Z'$ can significantly improve the current bound on a kinetic mixing parameter ϵ in the dark photon case, where $e\epsilon$ larger than $\mathcal{O}(10^{-5})$ with $g_X = calO(1)$ can be explored at Tera-Z experiments.

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