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B \rightarrow D(*) tau nu Decays in the 2HDM

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We analyze the recent experimental evidence for an excess of τ -lepton production in several exclusive semileptonic B -meson decays in the context of two-Higgs-doublet models. These decay modes are sensitive to the exchange of charged scalars and constrain strongly their Yukawa interactions. While the usual Type-II scenario cannot accommodate the recent BaBar data, this is possible within more general models in which the charged-scalar couplings to up-type quarks are not as suppressed. Both the $B \rightarrow D^{(*)} \tau \nu_\tau$ and the $B \rightarrow \tau \nu_\tau$ data can be fitted within the framework of the Aligned Two-Higgs-Doublet Model, but the resulting parameter ranges are in conflict with the constraints from leptonic charm decays. This could indicate a departure from the family universality of the Yukawa couplings, beyond their characteristic fermion mass dependence. We discuss several new observables that are sensitive to a hypothetical charged-scalar contribution, demonstrating that they are well suited to distinguish between different scenarios of new physics in the scalar sector, and also between this group and models with different Dirac structures; their experimental study would therefore shed light on the relevance of scalar exchanges in semileptonic $b \rightarrow c \tau^- \bar{\nu}_\tau$ transitions

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