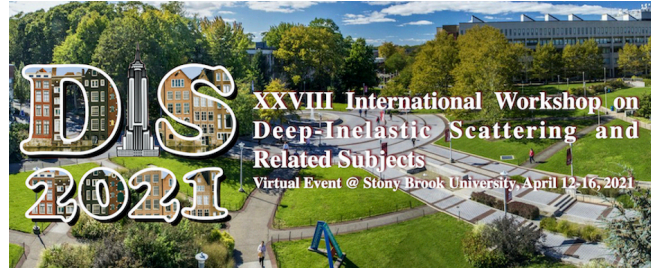


XXVIII International Workshop on Deep-Inelastic Scattering and Related Subjects



Contribution ID: 385

Type: **Contributed Talk**

Rare two-body decays of the top quark into a bottom meson plus an up or charm quark

Thursday, 15 April 2021 08:41 (18 minutes)

Rare two-body decays of the top quark into a neutral bottom-quark meson plus an up- or charm-quark: $t \rightarrow \bar{B}^0 + u, c$; $t \rightarrow \bar{B}_s^0 + c, u$; and $t \rightarrow \Upsilon(nS) + c, u$, are studied for the first time. The corresponding partial widths are computed at leading order in the non-relativistic QCD framework. The sums of all two-body branching ratios amount to $\mathcal{B}(t \rightarrow \bar{B}^0 + \text{jet}) \approx \mathcal{B}(t \rightarrow \bar{B}_s^0 + \text{jet}) \approx 4.2 \cdot 10^{-5}$ and $\mathcal{B}(t \rightarrow \Upsilon(nS) + \text{jet}) \approx 2 \cdot 10^{-9}$, respectively. The feasibility to observe the $t \rightarrow \bar{B}_{(s)}^0 + \text{jet}$ decay is estimated in top-pair events produced in proton-proton collisions at $\sqrt{s} = 14, 100$ TeV at the LHC and FCC, respectively. Combining many exclusive hadronic $\bar{B}_{(s)}^0$ decays, with J/ψ or $D^{0,\pm}$ final states, about 50 (16\,000) events are expected in 3 (20) ab^{-1} of integrated luminosity at the LHC (FCC), after typical selection criteria, acceptance, and efficiency losses. An observation of the two-body top-quark decay can also be achieved in the interesting $t \rightarrow b(\text{jet}) + c(\text{jet})$ dijet final state, where the $\bar{B}_{(s)}^0$ decay products are reconstructed as a jet, with 5\,300 and 1.4 million signal events above backgrounds expected after selection criteria at the LHC and FCC, respectively. Such unique final states provide a new direct method to precisely measure the top-quark mass via simple 2-body invariant mass analyses.

Primary authors: D'ENTERRIA, David (CERN); SHAO, Hua Sheng (LPTHE Paris)

Presenter: D'ENTERRIA, David (CERN)

Session Classification: QCD with Heavy Flavors and Hadronic Final States

Track Classification: QCD with Heavy Flavors and Hadronic Final States