



## Heavy $Q\bar{Q}$ "Fireball" Annihilation to Multi-Vector Bosons

*Saturday 7 July 2012 18:00 (1 hour)*

Drawing an analogy of replacing the nucleon by heavy (chiral) quark  $Q$ , the pion by longitudinal weak boson (i.e. Goldstone boson  $G$ ), and the  $\pi$ - $N$ - $N$  coupling by  $G$ - $Q$ - $Q$  Yukawa coupling, we construct a statistical model for annihilation of  $Q\bar{Q}$  into multi-Goldstone bosons, i.e.  $n$  longitudinal weak bosons. This analogy is becoming prescient since the LHC direct bound on heavy chiral quark (the 4th generation!) masses has reached above 600 GeV, hence entered the regime of perturbative unitarity violation, or strong coupling, much like the case for pion-nucleon coupling. Taking  $M_Q \sim \text{TeV}$ , the mean number of produced Goldstone bosons is of order 10 or more, with two or three boson production occupying only a very tiny fraction, hence would affect search strategy. This "fireball" process is controlled by a temperature of order  $v$ , the electroweak symmetry breaking scale. But this is no "blackhole", as only longitudinal weak bosons, plus perhaps one or two gluons, are emitted. Although we cannot estimate the  $Q\bar{Q}$  annihilation rate since the Yukawa coupling is now nonperturbative, but given that individual  $t'$  or  $b'$  decays are either suppressed by phase space ( $t' \rightarrow b'$  or  $b' \rightarrow t'$ ) or quark mixing, we view  $Q\bar{Q} \rightarrow nV$  as the likely outcome for ultra heavy  $Q\bar{Q}$  production at the LHC and beyond, which should be taken into account by the experiments.

**Author:** Prof. HOU, George W.-S. (National Taiwan University (TW))

**Presenter:** Prof. HOU, George W.-S. (National Taiwan University (TW))

**Session Classification:** Poster Session

**Track Classification:** Track 3 - BSM - Non-SUSY Exotics