PROCEEDINGS OF SCIENCE

Convener report of the session on Semileptonic Decays

Will E. Johns
Vanderbilt University
E-mail: will.johns@vanderbilt.edu

A brief summary and observations made by the convener of the Semileptonic Decays session.

The Xth Nicola Cabibbo International Conference on Heavy Quarks and Leptons,
October 11-15, 2010
Frascati (Rome) Italy

PoS(HQL 2010)084

1. CLEO-c [1]

Let me start by pointing out that I have waited a long time to see a direct and meaningful measurement of the ratio of semi–electronic to semi–muonic decay modes for charmed meson states. The recent CLEO measurement of around 95% (with largish error bars) for $\frac{D\to K^*\mu\nu}{D\to K^*e\nu}$ gives support for the number we have been using all these years and is a good step in the right direction. Another thing I found interesting in this particular analysis was the behavior of some form factors at low q^2. Even though the authors find no evidence for an f or d wave contribution, the abrupt shifts in the distributions proportional to $H_t(q^2)$ for the muon and $q^2h_0(q^2)H_0(q^2)$ for both muon and electron modes around $q^2 = 0.3\ GeV^2/c^4$ are striking, not observed in the model, and bear further investigation. Giovanni Bonvicini also showed the latest form factor distributions and accuracy estimates for V_{cd} using $D \to \pi e\nu$ and V_{ud} using $D \to Ke\nu$ with no surprises evident and good agreement with HPQCD if one uses known CKM values to make a comparison with $f_+(0)$ from the decays. We got a preview of the form factor analysis for $D \to \rho e\nu$ where the results for the ratios r_2 and r_v agree with the $D \to K^*\mu\nu$ values. We also saw a preview of results on for $D^+ \to \eta,\ \eta' e\nu$ and limits for $D^+ \to \phi e\nu$ and $D_s^+ \to \omega e\nu$. The assumption that these decays have a small rate, used in previous analyses of cabibbo suppressed D^+ semileptonic decays, seems justified. Finally, we saw an update of the inclusive semi–electronic results for all the D mesons: D^+, D^0, and, D_S^+. Isospin symmetry seems to work for the D^+ and D^0, rates, but the D_S^+ rate is lower relative to the other rates. The detailed reason for the difference is still open to interpretation, and the application of these CLEO results to help refine the calculations for the inclusive rates used to measure V_{ub} seems apparent.

2. BaBar [2]

BaBar investigated V_{ub} by measuring the exclusive decays $B^+ \to \pi^0,\ \eta,\ \eta',\ \rho\ell^+\nu$ and $B^0 \to \pi^-, \rho^-\ell^+\nu$. Paul Taras concentrated on the "$\pi-\eta$" analysis of the decays $B^0 \to \pi^-\ell^+\nu$, $B^+ \to \eta\ell^+\nu$, and $B^+ \to \eta'\ell^+\nu$ rather than on the "$\pi-\rho$" analysis of the decays $B^0 \to \pi^-\ell^+\nu$, $B^+ \to \pi^0\ell^+\nu$, $B^+ \to \rho\ell^+\nu$ and $B^0 \to \rho^-\ell^+\nu$. In the $\pi-\eta$ analysis, cuts are a little looser and backgrounds are a little higher, but the lattice results are not directly included into the fit of the q^2 distribution used to determine V_{ub}. The statistical overlap of the two measurements is expected to be low though very much correlated systematically and combining results is still under study. The two approaches agree with each other, and also, with large error bars, the inclusive result for V_{ub}. The ability to do analyses like this is a stepping-stone process and can just get better as the knowledge of the background contributions improves.

3. D^+, D_s^+ fully leptonic decays [3]

Marko Staric shared recent results from Babar for $D_s^+ \to \tau(\to e,\mu\nu)\nu$ and $D_s^+ \to \mu\nu$ as well as a recent HPQCD result and reviewed the status of the D fully leptonic decays. At first glance I thought that the new BaBar results should lower the world average, but Marko showed that the average will likely increase. This was a significant observation as the BaBar results were not included in a recent HFAG average for $f_{D_S^+}$. Even if the world average increases, agreement is still

good between the average and the latest HPQCD result. I was impressed with the signal quality coming from both Belle and BaBar for the fully leptonic decays.

4. LHCb[4]

Rob Lambert showed us some very clean semileptonic B decay peaks from LHCb early data. In fact, an audience member suggested loosening cuts to get even more yield since the data looked too clean! As higher statistics often yield new things, LHCb seems well poised to work toward their goal of looking for physics beyond the standard model. Hopefully the signal quality that we saw for the start–up data can be maintained as luminosities increase. After being involved in the battle for BTeV, it was personally heartening for me to see such good validation of the collider Heavy Flavor forward physics concept.

5. Overview

Weak annihilation contributions, be them in exclusive D^+ leptonic rates or the differences in D inclusive leptonic rates or even in measuring V_{ub} using both exclusive and inclusive information appeared as a common thread in the talks. Time was spent on indicating that there may not be as much tension in the D_s fully leptonic decays and the V_{ub} measurements as previously thought. Indeed, for the most part, much agreement was shown with expectations for most of the measurements. The standout exception to me was the $D \to K\pi\ell\nu$ decay. This decay tends to be more interesting every time we get more statistics!

References

[1] See Giovanni Bonvicini's session contribution, this conference, for specific information.

[2] See Paul Taras' session contribution, this conference, for specific information.

[3] See Marko Staric's session contribution, this conference, for specific information.

[4] See Rob Lambert's session contribution, this conference, for specific information.