

Belle II @ University of Louisville (UofL)

D. N. Brown, S. Banerjee

US Belle II Science Readiness Briefing
Jan 10-11 2019

UofL HEP group past and future interests

- Physics interests:
 - τ Physics (LFV/LNV/BNV, $|V_{us}|$, a_τ , 2nd class current), Dark Matter
- Technology interests at Belle II:
 - KLM, particle identification, Monte Carlo simulation/production
- Past achievements: Brown & Banerjee long-time *BABAR* members.
 - Brown *BABAR*: Simulation/Production, Event Display, Analysis Tools, pentaquark group, inclusive hadron production group
 - Brown Mu2e: Software Co-leader, HyperNews, Geometry Czar, LFV
 - Banerjee *BABAR*: τ Group, Simulation, Drift Chamber Gas System
 - Banerjee ATLAS: MET Trigger, Higgs to $\tau\tau$, LFV, ITk upgrade
 - Banerjee HFLAV/PDG : Former τ convenor, τ Review co-author

Other Recent Funding

- **UofL - Startup funding for Banerjee [2015 -]**
- **UofL - Special funds from Executive Vice President for Research and Innovation - Banerjee [2018 -]**
- **Intensity Frontier Fellowship at Fermilab - Brown [2017]**

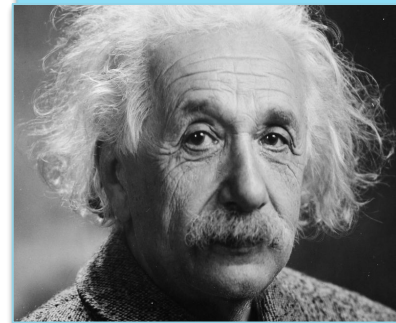
Faculty Summary

- David N. Brown, 70% Belle II, 30% Mu2e
 - Belle II: KLM , Monte Carlo simulation/production, dark matter, τ LFV
 - Mu2e: HyperNews admin, pion backgrounds
 - Postdoc: 1, shared with S. Banerjee
 - Graduate students: 2
 - Undergraduate students: 2 expected per year
- Swagato Banerjee, 100% Belle II
 - Belle II: KLM, particle ID, τ physics
 - Postdocs: 1, shared with D. Brown
 - Graduate students: 2
 - Undergraduate students: 1 expected per year

Postdoc Summary

- Postdoc To Be Named: 100% on Belle II
 - To start in July 2019
 - Particle identification: π^0 , pion-vs-kaon corrections
 - Search for second-class currents in τ decays
 - $\tau^- \rightarrow \pi^- \eta \nu_\tau$ has JPG = 0+-, 1--
 - $\eta \rightarrow \gamma \gamma$ (39%)
 - $\eta \rightarrow \pi^+ \pi^- \pi^0$ (23%)
 - $\eta \rightarrow \pi^0 \pi^0 \pi^0$ (33%)
 - Predicted by Weinberg (1958): not observed so far
 - Expected branching fraction $\sim 10^{-5}$ from isospin violation
 - Charged Higgs sensitivity competitive with $B^- \rightarrow \tau^- \bar{\nu}_\tau$

Optional
Photo



Graduate Student Summary

- Atanu Pathak: (100% on Belle II from FY19)
 - Started on Belle II in Oct 2018 [on ATLAS before that]
 - Expert shifter for KLM
 - Special mention at Poster competition on ITk simulation & performance studies at Graduate Student Fair, UofL
 - Thesis topic : τ decays at ATLAS & Belle II

- Diptaparna Biswas: (100% on Belle II from FY19)
 - Started on Belle II in Oct 2018 [on ATLAS before that]
 - Expert shifter on KLM
 - Slow control DAQ interface to KLM
 - Arts & Sciences Dean's Scholar award (2017)
 - Thesis topic : Search for dark matter at Belle II



Graduate Student Summary 2

- Grad student #3 (TBA): 100% on Belle II
 - To start on Belle II in August 2019
 - KLM related activities
 - Thesis topic : Search for LFV/LNV/BNV

- Grad student #4 (TBA): 100% on Belle II
 - To start on Belle II in August 2019
 - Particle ID related activities
 - Thesis topic : Measurement of $|V_{us}|$ with strange τ decays

Other People

- Number of Undergraduate Students:
 - 3 students
 - 10 hrs / week for 40 week/year = 400 hrs /yr

Focus:

- Projects related to particle identification
- Projects related to KLM service work
- Projects related to physics analysis tasks

Belle II Activities

- Major Belle II activities :
 - KLM :
 - slow control interface with configuration/logger DB
 - readout monitoring expert shifter during data-taking
 - background studies during cosmic & collision runs
 - Particle identification
 - Efficiency corrections in muon and KLong identification
 - Pi0 efficiency corrections using $(\tau^- \rightarrow \rho^- \nu_\tau) / (\tau^- \rightarrow \pi^- \nu_\tau)$
 - Pion-vs-Kaon corrections using $\tau^- \rightarrow h^- h^+ h^- \nu_\tau$ decays ($h=\pi/K$)
 - Monte Carlo simulation/production
 - Tauola contact for Physics Modelling/Generators [Banerjee]

Personnel % Belle II Effort by FY

	FY18	FY19	FY20	FY21
David N. Brown		70%	70%	70%
Swagato Banerjee		100%	100%	100%
Post-doc TBA		25%	100%	100%
Atanu Pathak		100%	100%	100%
Diptaparna Biswas		100%	100%	100%
Grad 3 TBA		16%	100%	100%
Grad 4 TBA		16%	100%	100%
3 Undergrads		60%	60%	60%
TOTAL FTEs:		4.9	7.3	7.3

- Assume FY= US Gov: FYN = Oct 1, N-1 to Sep 30, N
- Postdoc assumed to start in July 2019
- Graduate students #3 and #4 start in August 2019
- 400 hours/year for 3 undergraduates [normalized to 160 hours each = 1 month FTE or ~20% per student per year]

Personnel location by FY

	FY18	FY19	FY20	FY21
David N. Brown	UofL	UofL	UofL	UofL
Swagato Banerjee	UofL	UofL/KEK(**)	UofL/KEK(**)	UofL/KEK(**)
Post-doc TBA		UofL	KEK	KEK
Atanu Pathak	UofL	UofL/KEK(**)	KEK	UofL
Diptaparna Biswas	UofL	KEK	UofL	KEK
Grad 3 TBA		UofL/KEK(**)	UofL/KEK(**)	UofL/KEK(**)
Grad 4 TBA		UofL/KEK(**)	UofL/KEK(**)	UofL/KEK(**)
Undergrad		UofL	UofL	UofL

* **Sabbatical location**

** **Summer location**

Conclusion

- Our technical interests are KLM, Monte Carlo Simulation, Particle ID
- Our physics interests are τ Physics (LFV, $|V_{us}|$, a_τ , 2nd class), Dark Matter
- We plan to have **4** students doing Belle II theses in next 3 years
- **In 2017-2018 we achieved:**
 - Mu2e: New/improved geometry descriptions, conditions/alignment work
 - Brown: Intensity Frontier Fellowship at Fermilab 2017
 - ATLAS+CMS Run1 combination of Higgs coupling : $H \rightarrow \tau\tau$ with 5.5σ
 - ATLAS search for Higgs to lepton + τ with 13 TeV data : limits $\sim 0.3-0.4\%$
 - ITk layout for Strip and Pixel TDR; release coordinator for all ATLAS updates
 - Banerjee: U.S. ATLAS Distinguished Fellow 2017-2018
 - HFLAV τ branching fit; PDG co-author for section on τ branching fraction
 - 4th undergraduate Goldwater Scholar and 4th/5th outstanding graduating seniors (Conrad Smart 2017 - now: Cornell, Brent Mode 2018 - now: Wisconsin)