**IceCube Institutional Memorandum Of Understanding (MOU)**

**Scope of Work**

**University of Alabama**

**Dawn Williams**

**Ph.D Scientists** (Faculty Scientist/Post Doc Grads): **2** (2 0 3)

|  |  |  |  |  |  |  |  |  |  |
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| **Labor Cat.** | **Names** | **WBS L3** | **Tasks** | **WBS 2.1** | **WBS 2.2** | **WBS 2.3** | **WBS 2.4** | **WBS 2.5** | **Grand Total** |
| Program Management | Detector Maintenance & Operations | Computing & Data Management | Triggering & Filtering | Data Quality, Reconstruction & Simulation Tools |
| KE | Williams, Dawn | Detector Calibration | Managing flasher runs and coordinating low level calibration effort |  | 0.20 |  |  |  | 0.20 |
|  |  | TFT Coordination  Physics Filters | TFT board member  Tau WG lead |  |  |  | 0.10  0.25 |  | 0.10  0.25 |
|  | **Williams, Dawn Total** | |  |  | **0.20** |  | **0.35** |  | **0.55** |
|  | Toale, Patrick | Reconstruction/Analysis Tools  Simulation programs | Double cascade fitter  Trigger simulation |  |  |  |  | 0.10  0.10 | 0.10  0.10 |
|  | **Toale, Patrick Total** | |  |  |  |  |  | **0.20** | **0.20** |
| GR | Xu, Donglian | Simulation Programs | DeepCore simulation verification |  |  |  |  | 0.10 | 0.10 |
|  |  | Reconstruction/Analysis Tools | Improvements to low energy analysis framework |  |  |  |  | 0.10 | 0.10 |
|  |  | Monitoring | Monitoring shifts |  | 0.03 |  |  |  | 0.03 |
|  | **Xu, Donglian Total** | |  |  | **0.03** |  |  | **0.20** | **0.23** |
|  | Pepper, James | Detector Calibration | I3Live C&V |  | 0.10 |  |  |  | 0.10 |
|  |  | Detector Monitoring | Monitoring shifts |  | 0.03 |  |  |  | 0.03 |
|  | Triggering and Filtering | 2013 DeepCore filter and L2 proposal |  |  |  | 0.20 |  | 0.20 |
|  | **Pepper, James Total** | |  |  | **0.13** |  | **0.20** |  | **0.33** |
|  | Larson, Michael | Simulation Programs | Noise simulation |  |  |  |  | 0.15 | 0.15 |
|  |  | Triggering and Filtering | Track engine |  |  |  | 0.15 |  | 0.15 |
|  |  | Detector Monitoring | Monitoring shifts |  | 0.03 |  |  |  | 0.03 |
|  | **Larson, Michael Total** | |  |  | **0.03** |  | **0.15** | **0.15** | **0.33** |
| **UA Total** | |  |  |  | **0.39** |  | **0.70** | **0.55** | **1.64** |

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| **Labor Cat.** | **Names** | **WBS L3** | **Tasks** | **WBS 2.1** | **WBS 2.2** | **WBS 2.3** | **WBS 2.4** | **WBS 2.5** | **Grand Total** |
| Program Management | Detector Maintenance & Operations | Computing & Data Management | Triggering & Filtering | Data Quality, Reconstruction & Simulation Tools |
| PO | Postdoc To be hired | Reconstruction/ Analysis Tools | Extension of GENIE to higher energies, GENIE/nugen comparison |  |  |  |  | 0.10 | 0.10 |
|  |  | Reconstruction / Analysis Tools | Hybrid reconstruction tools |  |  |  |  | 0.20 | 0.20 |
|  |  | Detector Monitoring | Monitoring shifts |  | 0.03 |  |  |  | 0.03 |
|  | **PO TBD Total** | |  |  | **0.03** |  |  | **0.30** | **0.33** |

**Faculty:**

Dawn Williams – Institutional Lead, Calibration Coordinator, TFT Board Member, Tau Working Group Coordinator

Patrick Toale – hybrid reconstruction tools, trigger simulation

**Scientists and Post Docs:**

Postdoc to be hired – Extension of GENIE to higher energies, GENIE/nugen comparison, hybrid reconstruction tools, monitoring shifts

**Students:**

Donglian Xu (graduate student) - GENIE and noise simulation verification, atmospheric tau appearance analysis

James Pepper (graduate student) - verification monitoring integration into IceCube Live , 2013 DeepCore L2/ filter proposal, WIMP analysis

Michael Larson (graduate student) - noise simulation, track engine, monitoring shifts

**UA General M&O (non-science) IceCube Responsibilities and Contributions:**

The Alabama Group’s major responsibilities and contributions towards maintenance and operations of the IceCube experiment include:

* Primary institutional responsibility for overseeing flasher operations and software.
* Major responsibility for calibration coordination, including ice model working group activities
* Major responsibility for tau neutrino analysis, tau working group lead

**Analysis:** The main analysis focus at the University of Alabama is searching for the lowest energy tau neutrinos that are identifiable “double pulses”. At energies at and above 100 TeV, the “double bang” signature of a high energy tau neutrino becomes a double pulse in the IceCube waveform. There is no appreciable tau signal from the atmosphere at these energies, so a tau signature such as a double pulse would be strong evidence of cosmological origin. At lower energies, Alabama is undertaking a search for the appearance of atmospheric tau neutrinos from oscillation, which would manifest as an excess of cascade-like events.

Alabama is developing an algorithm to identify double pulse waveforms both online and offline. The offline tau search and the atmospheric appearance analysis require high quality cascade reconstruction, so Alabama is also working on multiple cascade reconstruction algorithms and calibration of cascades with flashers.