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

**Scope of Work**

**Michigan State University**

**Tyce DeYoung**

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Labor Cat.** | **Names** | **WBS L3** | **Tasks** | **Funds Source** | **WBS 2.1** | **WBS 2.2** | **WBS 2.3** | **WBS 2.4** | **WBS 2.5** | **WBS 2.6** | **Grand Total** |  |
| Program Coordination | Detector Maintenance & Operations | Computing & Data Management  | Data Processing & Simulation  | Software | Calibration |  |
| KE | DeYOUNG, TYCE | Education & Outreach | Education & Outreach | Inst. In-Kind | 0.05 |  |  |  |  |  | **0.05** |  |
|  |  | Administration | Executive committee | Inst. In-Kind | 0.05 |  |  |  |  |  | **0.05** |  |
|   | **DeYOUNG, TYCE Total** |  |  | **0.10** |  |  |  |  |  | **0.10** |  |
|   | MAHN, KENDALL | Simulation Software  | Integration/development of GENIE for low energy systematics | Inst. In-Kind |  |  |  |  | 0.05 |  | **0.05** |  |
|   | **MAHN, KENDALL Total** |  |  |  |  |  |  | **0.05** |  | **0.05** |  |
| PO | TBD | Simulation Production | Simulation Production | Inst. In-Kind |  |  |  |  |  |  |  |  |
|  |  | Central Computing Resources | Simulation production site manager at MSU/Condor integration | NSF M&O Core |  |  |  |  |  |  |  |  |
|   | **PO TBD Total** |  |  |  |  |  |  |  |  |  |  |
| GR | NEER, GARRETT | Detector calibration | In-situ DOM sensitivity calibration/angular response from muon neutrinos | Inst. In-Kind |  |  |  |  |  | 0.25 | **0.25** |  |
|   | **NEER, GARRETT Total** |  |  |  |  |  |  |  | **0.25** | **0.25** |  |
| GR  | RYSEWYK, DEVYN | Detector Monitoring | Monitoring Shifts | Inst. In-Kind |  | 0.03 |  |  |  |  | **0.03** |  |
|  | Education & Outreach | Education & Outreach | Inst. In-Kind | 0.10 |  |  |  |  |  | **0.10** |  |
| **RYSEWYK, DEVYN Total** |  |  | **0.10** | **0.03** |  |  |  |  | **0.13** |  |
| GR | MICALLEF, JESSIE |  |  |  |  |  |  |  |  |  |  |  |
|   | **MICALLEF, JESSIE Total** |  |  |  |  |  |  |  |  |  |  |
| **MSU Total** |  |  |  | **0.20** | **0.03** |  |  | **0.05** | **0.25** | **0.53** |  |

Michigan State contributions to the maintenance and operations of IceCube include:

**Faculty:**

Tyce DeYoung – Exec. comm., outreach, 100% IceCube

Kendall Mahn – low energy systematics/GENIE, 5% IceCube (95% GENIE, T2K, DUNE)

**Scientists and Post Docs:**

PO TBD – simprod, distributed computing, other contributions TBD once candidate is identified

**Ph.D. Students:**

Garrett Neer Reco/analysis tools: DOM calibration using neutrino-induced muons.

 Thesis/Analysis topics: dark matter search using LE and ME contained events

Devyn Rysewyck Detector monitoring: shift
Education and outreach: SP Experiment jury, Science Fest Q&A

 Thesis/Analysis topics: Extended Galactic source search, IceACT R&D

Jessie Micallef currently TA, plan to join strike team once done with coursework

 Thesis/Analysis topics: Next-generation oscillation analysis

**Computing Resources:**

**MSU Pledged Computing Resources**

|  |  |
| --- | --- |
|  | **2017** |
|  | **CPU Cores** | **GPU Cards** |
| **IceCube**  | 500\* | 8\* |
| **PINGU** |  |  |
| **Gen2**  |  |  |

**\*as simprod by policy does not carry out low energy signal production, the primary computational task for low energy physics, these resources will be available for IceCube multi-institutional computing but not necessarily under simprod**

**Computing Resources Typically Available**

|  |  |
| --- | --- |
|  | **2017** |
|  | **CPU Cores** | **GPU Cards** |
| **IceCube**  | 1000 (est.) | 200 (est.) |
| **PINGU** |  |  |
| **Gen2**  |  |  |

The Michigan State IceCube group has access to several large computing clusters maintained and administered by the Michigan State High Performance Computing group and the Institute for Cyber-Enabled Research, comprising a total of approximately 15,600 computing cores, including 80 Tesla K20c and 200 Tesla K80 GPU cards. Of these, 728 cores 8 K80 GPUs are dedicated to IceCube. Actual availability will be very substantially higher for jobs with durations less than 4 hours, but cannot be accurately estimated until simprod begins sending processing jobs to MSU.

**Note:** The activities and staffing levels in this MoU are appropriate for the six-month period beginning Sept 1, 2017.