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

**Scope of Work**

**University of Wisconsin - Madison**

**Albrecht Karle**

**Ph.D Scientists** (Faculty Scientist/Post Doc Grads): **20** (6 14 9)

| **Labor Cat.** | **Names** | **WBS L3** | **Tasks** | **Funds Source** | **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 | HALZEN, FRANCIS | Administration | Principle Investigator | NSF M&O Core | 0.38 |  |  |  |  | 0.38 |
|  |  |  | Inst. In-Kind | 0.12 |  |  |  |  | 0.12 |
|  | **HALZEN, FRANCIS Total** | | |  | **0.50** |  |  |  |  | **0.50** |
|  | KARLE, ALBRECHT | Administration | Associate Director for Science and Instrumentation | NSF M&O Core | 0.38 |  |  |  |  | 0.38 |
|  |  |  | ExecCom Member | Inst. In-Kind | 0.20 |  |  |  |  | 0.20 |
|  | **KARLE, ALBRECHT Total** | | |  | **0.58** |  |  |  |  | **0.58** |
|  | HANSON, KAEL | Administration | Director of IceCube Maintenance and Operations | NSF M&O Core | 0.47 |  |  |  |  | 0.47 |
|  |  |  |  | Inst. In-Kind | 0.08 |  |  |  |  | 0.08 |
|  | **HANSON, KAEL Total** | | |  | **0.55** |  |  |  |  | **0.55** |
|  | VANDENBROUCKE, JUSTIN | Administration | Pubcom member | Inst. In-Kind | 0.10 |  |  |  |  | 0.10 |
|  | **VANDENBROUCKE, JUSTIN Total** | | |  | **0.10** |  |  |  |  | **0.10** |
| SC | CHIRKIN, DMITRY | Detector Calibration | Direct photon tracking / ice- properties calibration | Base Grants |  | 0.30 |  |  |  | 0.30 |
|  |  | Reconstruction/ Analysis tools | Reconstruction software | NSF M&O Core |  |  |  |  | 0.30 | 0.30 |
|  |  | Simulation Programs | Maintain and Verify Simulation of Photon Propagation and update Ice Properties | NSF M&O Core |  |  |  |  | 0.40 | 0.40 |
|  | **CHIRKIN, DMITRY Total** | |  |  |  | **0.30** |  |  | **0.70** | **1.00** |
|  | DESIATI, PAOLO | Simulation Production | Simulation Production Manager | NSF M&O Core |  |  | 0.20 |  |  | 0.20 |
|  |  | Simulation Production | Simulation Production streamlining programs for the cloud, GPU | NSF M&O Core |  |  | 0.40 |  |  | 0.40 |
|  |  | Simulation Production | Simulation Production panel chair | Inst. In-Kind |  |  | 0.20 |  |  | 0.20 |
|  |  | Detector Ops. And Maintenance | IceCube Coordination Committee Chair | NSF M&O Core |  | 0.20 |  |  |  | 0.20 |
|  | **DESIATI, PAOLO Total** | |  |  |  | **0.20** | **0.80** |  |  | **1.00** |
|  | DUVERNOIS, MICHAEL | Engineering and R&D Support | Specialized simulations, designing new filters, unusual data selections, extracting specialized information | NSF M&O Core | 0.25 |  |  |  |  | 0.25 |
|  |  | Engineering and R&D Support | Ongoing EMI studies & mitigation, South Pole & Northern test site instrumentation, Summer South Pole field work | NSF M&O Core | 0.25 |  |  |  |  | 0.25 |
|  | **DUVERNOIS, MICHAEL Total** | | |  | **0.50** |  |  |  |  | **0.50** |
|  | HOSHINA, KOTOYO | Simulation Programs | NuGen maintenance | NSF M&O Core |  |  |  |  | 0.25 | 0.25 |
|  | **HOSHINA, KOTOYO Total** | | |  |  |  |  |  | **0.25** | **0.25** |
|  | KAUER, MATTHEW | Run Coordination | Run Coordinator | NSF M&O Core |  | 0.40 |  |  |  | 0.40 |
|  | Detector Monitoring | Training and coordinating monitoring shifters | NSF M&O Core |  | 0.10 |  |  |  | 0.10 |
|  | TFT Coordination | TFT Board member | Inst. In-Kind |  |  |  | 0.10 |  | 0.10 |
|  |  | Detector Monitoring | Data Monitoring lead: coordinate test and feature dev.; design underlying analysis algorithms | NSF M&O Core |  | 0.20 |  |  |  | 0.20 |
|  |  | IceTop Operations | Design and build experimental apparatus for restoring IceTop detector efficiency | NSF M&O Core |  | 0.20 |  |  |  | 0.20 |
|  | **KAUER, MATTHEW Total** | |  |  |  | **0.90** |  | **0.10** |  | **1.00** |
|  | KELLEY, JOHN | Detector Maintenance & Ops | Detector Maintenance and Operations Manager | NSF M&O Core |  | 0.65 |  |  |  | 0.65 |
|  |  | Data Acquisition | DOM software: DOR device driver, DOMHub scripts, DOMCal | NSF M&O Core |  | 0.15 |  |  |  | 0.15 |
|  |  | Data Acquisition | Track DOM issues, generate detector run configurations | NSF M&O Core |  | 0.10 |  |  |  | 0.10 |
|  | **KELLEY, JOHN Total** | | |  |  | **0.90** |  |  |  | **0.90** |
|  | TOSI, DELIA | Detector Calibration | Absolute DOM sensitivity calibration (laboratory measurements) | NSF M&O Core |  | 0.30 |  |  |  | 0.30 |
|  | IceTop Operations | Test and commission experimental apparatus for restoring IceTop detector efficiency | NSF M&O Core |  | 0.20 |  |  |  | 0.20 |
|  | **TOSI, DELIA Total** | | |  |  | **0.50** |  |  |  | **0.50** |
|  | WENDT, CHRISTOPHER | Detector Calibration | Flasher output, flasher calibration | NSF M&O Core |  | 0.40 |  |  |  | 0.40 |
|  |  | Detector Calibration | DOM charge response, linearity, DOM cal support | NSF M&O Core |  | 0.40 |  |  |  | 0.40 |
|  | **WENDT, CHRISTOPHER Total** | | |  |  | **0.80** |  |  |  | **0.80** |
| PO | DAY, MELANIE | Simulations Production | Low energy simulation production | Base Grants |  |  | 0.30 |  |  | 0.30 |
|  | DAY, MELANIE **Total** | |  |  |  |  | **0.30** |  |  | **0.30** |
|  | WANDKOWSKY, NANCY | Data Storage & Transfer | Analysis disk Data storage review, data filters | Base Grants |  |  | 0.10 |  |  | 0.10 |
|  | WANDKOWSKY, NANCY | Offline Data Processing | Level 2 offline processing – co-coordinator | Base Grants |  |  |  |  | 0.20 | 0.20 |
|  | **WANDKOWSKY, NANCY Total** | |  |  |  |  | **0.10** |  | **0.20** | **0.30** |
|  | UW PO | Detector Monitoring | Monitoring shifts | Base Grants |  | 0.08 |  |  |  | 0.08 |
|  | **UW PO Total** | |  |  |  | **0.08** |  |  |  | **0.08** |
| GR | JERO, KYLE | Reconstruction/ Analysis Tools | Event reconstruction, angular resolution | Base Grants |  |  |  |  | 0.20 | 0.20 |
|  |  | Simulation programs | Veto simulation, Corsika development | Base Grants |  |  |  |  | 0.20 | 0.20 |
|  | SABBATINI, LUCA | Reconstruction/ Analysis Tools | Shower reconstruction, flasher data | Inst. In-Kind |  |  |  |  | 0.30 | 0.30 |
|  | TOBIN, MORIAH | Reconstruction/ Analysis Tools | Low energy event reconstruction (BiPed), spline service | Base Grants |  |  |  |  | 0.30 | 0.30 |
|  | GHORBANI, KEVIN | Detector Calibration | Muon time residuals/hole ice | Base Grants |  | 0.25 |  |  |  | 0.25 |
|  | FAHEY, SAM | Physics Filters | Trigger simulations | Base Grants |  |  |  | 0.20 |  | 0.20 |
|  | MANCINA, SARAH | Detector Calibration | muon neutrinos, DOM sensitivity | Inst. In-kind |  | 0.20 |  |  |  | 0.20 |
|  | UW GR | Detector Monitoring | Monitoring shifts | Base Grants |  | 0.12 |  |  |  | 0.12 |
|  | **GR Total** | |  |  |  | **0.57** |  | **0.20** | **1.00** | **1.77** |
| **UW – Madison Total** | | |  |  | **2.23** | **4.00** | **1.20** | **0.30** | **2.40** | **10.13** |

**Faculty:**

At UW-Madison physics faculty teach half-time, one course per semester. Additionally, faculty who are members of WIPAC (Karle, Halzen, Westerhoff, Vandenbroucke) are relieved of teaching for one semester per year. Thus faculty are on research except for the time spent on teaching one course per year.

Halzen, Francis Principal Investigator

Karle, Albrecht Institutional Lead, ExecCom member, Point and diffuse astrophysical neutrinos, DeepCore

Hanson, Kael Director of IceCube Maintenance & Operations

Vandenbroucke, Justin Low energy physics, IceCube analysis, selected point source searches

Westerhoff, Stefan Cosmic Rays with IceCube and IceTop.

Gallagher, John Selection of candidate point sources of neutrinos, catalogues for stacking searches and multi-wavelength observations.

**Scientists:**

Ahlers, Marcus (John Bahcall Fellowship).

Analysis: GRB physics analysis, neutrino sources

Chirkin, Dmitry Service: Direct photon tracking with graphics computers / ice properties calibration; event reconstruction software, Simulation Programs, event recon.

Analysis: energy reconstruction of high energy events, ice properties.

Desiati, Paolo Service: Simulation Production Coordinator, Sim. Prod. Panel Chair

Analysis: Atmospheric neutrinos, time dependence, charm

DuVernois, Michael (50%) Service: Engineering Support and R&D Science Support

Hoshina, Kotoyo (75% appointment with University of Tokyo, based in Madison)

Service: Simulation Programs - nugen maintenance

Analysis: Earth Core neutrino absorption (Tokyo)

Kauer, Matthew Service: Run Coordinator, TFT Board Member, IceCube Monitoring Lead, Cosmic Ray Surface Array Development

Kelley, John (90%) Service: Detector Maintenance and Operations Manager, DOM Cal Maintenance, DOM issues technical analysis

Tosi Delia Service: Absolute DOM sensitivity calibration, Scintillation detectors (IceTop maintenance)

Analysis: IceTop veto for astrophysical neutrino search

Wendt, Christopher (80%) Service: Flasher output, Flasher Calibrations; DOM sensitivity, Supporting DOM charge response (lab, flashers), DOM Cal support

**Post Docs** (supervisor)**:**

Bechtol, Keith (JV) Service: TBD

Analysis: Correlations between neutrino flux and gamma ray observations

Day, Melanie (AK) Service: Low energy simulation production

Analysis: Neutrino oscillations with Deep Core, Non Standard Interactions

Fiorino, Daniel (SW) Service: TBD

Analysis: IceCube/HAWC anisotropy

Wandkowsky, Nancy (AK) Service: Analysis disk Data storage review, filter development

Analysis: All flavor all sky contained vertex neutrino analysis at high energies

Donglian Xu (AK) Service: Calibration, waveforms, cascade systematics

Analysis: Search for neutrino flux in coincidence with fast radio transients. Investigation of non-contained high energy cascade events in IceCube

**Grad Students** (supervisor)**:**

Fahey, Sam (JV) Service: Trigger simulations

Analysis: Analysis of transients

Ghorbani, Kevin (FH) Service: Muon time residuals/hole ice

Thesis /Analysis topics: Sterile neutrino search

Griffith, Zachary (SW) Thesis /Analysis topics: search for gamma-ray sources in IceTop with IceCube muon veto

Service: TBD

Jero, Kyle (AK) Service: DOM linearity, sensitivity; muon event reconstruction

Analysis: point sources, atmospheric neutrino veto

Kheirandish, Ali (FH) Service: Supernova system rate studies

Analysis: Supernova, GRB, Point sources

Mancina, Sarah (AK) Service: Calibration studies (DOM sensititvity) with muon neutrinos

Analysis: muon neutrinos

Sabbatini, Luca (FH) Service: shower reconstruction, flasher data

Analysis: GRB search, model independent

Tobin, Moriah (AK) Service: low energy event reconstruction (BiPed), spline service

Analysis: Atmospheric neutrino studies using IceCube's DeepCore.

Wille, Logan (FH) Analysis: Charm contribution to the atmospheric neutrino flux