**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 11)

| **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 | 0.75 |   |   |  |   | 0.75 |
|  | **HANSON, KAEL Total** |  | **0.75** |  |  |  |  | **0.75** |
|   | VANDENBROUCKE, JUSTIN | Administration | Pubcom member | Inst. In-Kind | 0.10 |   |   |  |   | 0.10 |
|  | **VANDENBROUCKE, JUSTIN Total** |  | **0.10** |  |  |  |  | **0.10** |
| SC | CHIRKIN, DMITRY | Reconstruction/ Analysis tools | Direct photon tracking / ice- properties calibration  | Base Grants |   |   |   |   | 0.15 | 0.15 |
|  |  | Reconstruction/ Analysis tools | Reconstruction software | NSF M&O Core |   |   |   |   | 0.15 | 0.15 |
|   |   | Simulation Programs | Maintain and Verify Simulation of Photon Propagation and update Ice Properties | NSF M&O Core |   |   |   |   | 0.35 | 0.35 |
|   | **CHIRKIN, DMITRY Total** |  |  |  |  |  |  | **0.65** | **0.65** |
|   | DESIATI, PAOLO | Simulation Production | Coordination of Simulation Production | NSF M&O Core |   |   | 0.35 |   |   | 0.35 |
|   |  | Simulation Production | Simulation Production panel chair | Inst. In-Kind |   |   | 0.20 |   |   | 0.20 |
|   |  | Administration  | Coordination Committee Chair | NSF M&O Core |  0.20 |   |  |   |   | 0.20 |
|   | **DESIATI, PAOLO Total** |  |  | **0.20** |  | **0.55** |  |  | **0.75** |
|  | 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** |
|  | KELLEY, JOHN | Detector Maintenance & Ops | Detector Maintenance and Operations Manager  | NSF M&O Core |  | 0.70 |  |  |  | 0.70 |
|  |  | Data Acquisition | DOM software: DOR device driver, DOMHub scripts, DOMCal | NSF M&O Core |  | 0.10 |  |  |  | 0.10 |
|  |  | 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 | IceTop maintenance  | 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 |   | 0.20 |   |   |   | 0.20 |
|   |  | Detector Calibration | Absolute DOM sensitivity calibration (laboratory measurements) | NSF M&O Core |   | 0.40 |   |   |   | 0.40 |
|   |  | Detector Calibration | DOM charge response, linearity, DOM cal support | NSF M&O Core |   | 0.20 |   |   |   | 0.20 |
|   | **WENDT, CHRISTOPHER Total** |  |  | **0.80** |  |  |  | **0.80** |
| PO | DAY, MELANIE | Simulations Production | Low energy simulation production | Base Grants |  |   | 0.25  |  |  | 0.25 |
|   | DAY, MELANIE **Total** |  |  |  |  | **0.25** |  |  | **0.25** |
|   | KAUER, MATTHEW | Run Coordination | Run Coordinator | NSF M&O Core |  | 0.40 |  |  |  | 0.40 |
|  | TFT Coordination | 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 | IceCube Monitoring Lead | NSF M&O Core |  | 0.20 |  |  |  | 0.20 |
|  |  | IceTop Operations | Cosmic Ray Surface Array Development | NSF M&O Core |  | 0.20 |  |  |  | 0.20 |
|   | **KAUER, MATTHEW Total** |  |  |  | **0.80** |  | **0.20** |  | **1.00** |
|  | WANDKOWSKY, NANCY | Data Storage & Transfer | Analysis disk Data storage review, data filters  | Base Grants |  |  | 0.15 |  |  | 0.15 |
|   | **WANDKOWSKY, NANCY Total** |  |  |  |  | **0.15** |  |  | **0.15** |
|   | UW PO | Detector Monitoring | Monitoring shifts | Base Grants |   | 0.08 |   |   |   | 0.08 |
|   | **UW PO Total** |  |  |  | **0.08** |  |  |  | **0.08** |
| GR | ~~FEINTZEIG, JACOB~~ | ~~Reconstruction/ Analysis tools~~ | ~~Event reconstruction (spline fits)~~ | ~~Base Grants~~ |  |  |  |  | ~~0.10~~ | ~~0.10~~ |
|  | ~~Offline Data Processing~~ | ~~L3 processing, muon stream~~ | ~~Base Grants~~ |  |  |  |  | ~~0.10~~ | ~~0.10~~ |
|  | ~~GLADSTONE, LAURA~~ | ~~Reconstruction/ Analysis tools~~ | ~~Reconstruction Tools- Deep Core~~ | ~~Base Grants~~ |  |  |  |  | ~~0.15~~ | ~~0.15~~ |
|  | ARGUELLES, CARLOS  | Reconstruction/ Analysis Tools | Neutrino generation and systematics | Base Grants |  |  |  |  | 0.20 | 0.20 |
|  | MCNALLY, FRANK | Simulation Production | IceTop Simulation Production / Data Processing | Base Grants |   |   | 0.30 |   |   | 0.30 |
|  | ~~Riedel, BenediKt~~ | ~~Supernova System~~ | ~~Supernova DAQ~~ | ~~Base Grants~~ |  | ~~0.20~~ |  |  |  | ~~0.20~~ |
|  | ~~VAN SANTEN, JAKOB~~ | ~~Reconstruction/ Analysis tools~~ | ~~Cascades~~ | ~~Base Grants~~ |  |  |  |  | ~~0.15~~ | ~~0.15~~ |
|  | ~~Simulation programs~~ | ~~Muongun~~ | ~~Base Grants~~ |  |  |  |  | ~~0.20~~ | ~~0.20~~ |
|   | JERO, KYLE | Reconstruction/ Analysis Tools | Event reconstruction, angular resolution | Base Grants |   |  |   |   |  0.20 | 0.20 |
|   |  | Simulation programs | Veto simulation | 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 |
|  | MIDDLEMAS, ERIN  | Reconstruction/ Analysis Tools | Cascade event reconstruction | Base Grants |  |  |  |  | 0.30 | 0.30 |
|  | GHORBANI, KEVIN  | Detector Calibration | Muon time residuals/hole ice | Base Grants |  | 0.25 |  |  |  | 0.25 |
|  | ~~ALSUM, SHAUN~~  | ~~Reconstruction/ Analysis Tools~~ | ~~Calibration, investigate ice and geometry using muons~~ | ~~Base Grants~~ |  |  |  |  | ~~0.30~~ | ~~0.30~~ |
|  | FAHEY, SAM | Physics Filters | Trigger simulations | Base Grants |  |  |  | 0.20 |  | 0.20 |
|   | UW GR | Detector Monitoring | Monitoring shifts | Base Grants |   | 0.12 |   |   |   | 0.12 |
|   | **GR Total** |  |  |  | **0.37** | **0.30** | **0.20** | **1.50** | **2.37** |
| **UW – Madison Total** |  |  | **2.63** | **3.45** | **1.25** | **0.40** | **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

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)

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

Tosi Delia Service: Absolute DOM sensitivity calibration

 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:**

Bechtol, Keith Service: TBD

 Analysis: High energy neutrinos

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

 Analysis: Deep Core Analysis, neutrino oscillations

Fiorino, Daniel (SW) Service: TBD

 Analysis: IceCube/HAWC anisotropy

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

Salvado Serra, Jordi (FH) Analysis: sterile neutrinos with IC79 and IC86-1

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

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

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

Arguelles, Carlos (FH) Service: neutrino generation and systematics

 Analysis: Sterile neutrinos and atmospheric solar neutrinos

Fahey, Sam (JV) Service: Trigger simulations

 Analysis: TBD

~~Feintzeig, Jacob (AK) Service: Ice Properties Calibration, event reconstruction (spline fitting), IC86 2012 L3 muon offline processing, online processing support (muon channel)~~

 ~~Analysis: muons, point sources IC79, IC86-1, HESE, MESE~~

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

 Thesis /Analysis topics: Sterile neutrino search

~~Gladstone, Laura (AK) Service: Reconstruction tools - deep core~~

 ~~Thesis topic: Neutrino oscillations with Deep Core~~

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

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

McNally, Frank (SW) Service: IceTop simulation production/data processing

 Analysis: IceTop anisotropy, study of composition as a function of sky location, cosmic-ray spectrum and composition with IceCube/IceTop

Middlemas, Erin (AK) Service: Cascade event reconstruction

 Analysis: cascade analysis at PeV energies

~~Riedel, Benedikt (FH) Service: Supernova simulation, pDAQ testing for supernovae (investigating its robustness for a bright event), SNEWS and supernova alert maintenance~~

 ~~Thesis: Supernova neutrinos with IceCube~~

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.

~~Van Santen, Jakob (AK) Service: Calibration of DOM waveforms, cascade offline filter support, new simulation production tools (muon gun)~~

 ~~Thesis topic: “Measurement of contained neutrino interactions above 1 TeV in IceCube: Comparison with atmospheric predictions and investigation for an astrophysical component.”~~

~~Weaver, Chris (AK) Service: Calibration support~~

 ~~Thesis topic: “Diffuse astrophysical muon neutrinos”~~

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