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

**Scope of Work**

**University of Münster**

**Alexander Kappes**

**Ph.D Scientists** (Faculty Scientist/Post Doc Grads): **2** (1 1 6)

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| **Labor Cat.** | **Names** | **WBS Level 3** | **Tasks** | 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 | KAPPES, Alexander | 2.1.1 Administration | Institutional lead | 0.20 |   |   |   |   |  | 0.20 |
|   | **KAPPES, Alexander, Total** |  | **0.20** |  |  |  |  |  | **0.20** |
| PD | CLASSEN, Lew | 2.1.4 Education & Outreach  | Public outreach |   0.10 |  |   |   |  |  | 0.10 |
|   | **CLASSEN, Lew Total** |  | **0.10** |  |  |  |  |  | **0.10** |
| GR | BUSSE,Raffaela | 2.1.4 Education & Outreach | Public outreach | 0.10 |  |   |   |  |  | 0.10 |
|   | **BUSSE, Raffaela Total** |  | **0.10** |  |  |  |  |  | **0.10** |
| **University Münster Total**  |  | **0.40** |  |  |  |  |  | **0.40** |

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| **Labor Cat.** | **Names** | **WBS Level 3** | **Tasks** | WBS 1.1 | WBS 1.2 | WBS 1.3 | WBS 1.4 | WBS 1.5 | WBS 1.6 | **Grand Total** |
| Project Office | Gen2 Enhanced Hot Water Drill | Deep Ice Sensor Modules | Comms, Power, and Timing | Characterization & Calibration | M&O Data Systems Integ. |
| KE | KAPPES, Alexander | 1.3.1 mDOM | L3 lead |  |   | 0.50 |   |   |  | 0.50 |
|   | **KAPPES, Alexander, Total** |  |  |  | **0.50** |  |  |  | **0.50** |
| SC | CLASSEN, Lew | 1.3.1 mDOM | Development, characterization, simulations |    |  |  0.40 |   |  |  | 0.40 |
|   | **CLASSEN, Lew Total** |  |  |  | **0.40** |  |  |  | **0.40** |
| GR | UNLAND, Martin | 1.3.1 mDOM | Development, characterization, simulations |   |  |  0.70 |   |  |    | 0.70 |
|  | UNLAND, Martin | 1.6.3 Simulation Software | Noise simulation |  |  |  |  |  | 0.10 | 0.10 |
|   | **UNLAND, Martin Total** |  |  |  | **0.70** |  |  | **0.10** | **0.80** |
|  | ÜBERHOLZ, Martin | 1.3.1 mDOM | PMT testing |   |  |  0.50 |   |  |    | 0.50 |
|   | **ÜBERHOLZ, Ken Total** |  |  |  | **0.50** |  |  |  | **0.50** |
|  | DITTMER, Markus | 1.3.1 mDOM | Background characterization |  |   | 0.50 |  |   |  | 0.40 |
|  | **DITTMER, Markus Total** |  |  |  | **0.50** |  |  |  | **0.40** |
|  | LOZANO, Cris | 1.5.3 Array Calibration | Studies to determine hole-ice properties |   |  |  |   |  0.20 |    | 0.20 |
|   | **LOZANO, Cris Total** |  |  |  |  |  | **0.20** |  | **0.20** |
|  | HERRLICH, Ralf | 1.5.3 Array Calibration | Studies to determine mDOM position in hole ice |   |  |  |   |  0.20 |    | 0.20 |
|   | **HERRLICH, Ralf Total** |  |  |  |  |  | **0.20** |  | **0.20** |
| **University Münster Total**  |  |  |  | **2.6** |  | **0.40** | **0.10** | **3.1** |

**Faculty:**

Alexander Kappes (Faculty) – Institutional Lead, L3 lead mDOM

**Scientists and Post Docs:**

Lew Classen (Post Doc) – mDOM development

**Grad Students (PhD students):**

Cristian Lozano (PhD student) – Thesis topic: Sensitivity studies of IceCube-Gen2 detector with mDOMs

Martin Unland (PhD student) – Thesis topic: mDOM development and detailed module characterization

Raffaela Busse (PhD student) – Thesis topic: Constraining minimal Dark Mater models with data from the IceCube Neutrino Observatory

**Master students:**

Ralf Herrlich – Thesis topic: Position calibration of mDOMs with flasher LEDs

Ken Überholz – Thesis topic: Construction and commissioning of a magnetic test stand for PMTs

Markus Dittmer – Thesis topic: Characterization of background from scintillation in pressure vessel