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

**Scope of Work**

**Yale University**

**Reina Maruyama**

**Ph.D Scientists** (Faculty Scientist/Post Doc Grads): **1** (1 0 1)

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| **Labor Cat.** | **Names** | **WBS Level 3** | **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 | Reina Maruyama | Supernova System | Supernova DAQ | Inst. In-Kind |  | 0.05 | |  | |  | |  | | 0.05 |
|  | Engineering and R&D Support | Gen2 R&D | Inst. In-Kind | 0.05 |  | |  | |  | |  | | 0.05 |
|  | Reconstruction / Analysis Tools | Coincident events between IceCube and DM-Ice, low energy reconstruction | Inst. In-Kind |  |  | |  | |  | | 0.05 | | 0.05 |
|  | **Reina Maruyama Total** | |  |  | **0.05** | **0.05** | |  | |  | | **0.05** | | **0.15** |
| GR | Antonia Hubbard | Reconstruction / Analysis Tools | Coincident events between IceCube and DM-Ice, characterization of untriggered IceCube events, low energy reconstruction |  |  |  | |  | |  | | 0.05 | | 0.05 |
|  | **Antonia Hubbard Total** | |  |  |  |  | |  | |  | | **0.05** | | **0.05** |
| **Yale Total** | | |  |  | **0.05** | | **0.05** | |  | |  | | **0.10** | **0.20** |

**Faculty:**

Reina Maruyama – Supernova DAQ and Simulation tools, dark matter search, coincidence with DM-Ice

**Scientists and Post Docs:**

TBD – low-energy reconstruction

**Grad Students:**

Antonia Hubbard – Development of coincidence searches between IceCube and DM-Ice, characterization of low energy events untriggered in IceCube

Thesis/analysis topics: Backgrounds for DM-Ice: Coincidence Events Between IceCube and DM-Ice

**Overall summary of M&O responsibilities and analysis topics**

A postdoc TBD and Antonia Hubbard (NSF Graduate Fellow, now paid for from Yale) is looking at coincidence events between DM-Ice and IceCube. These coincident events offer opportunities for improving reconstruction, especially for low energy events, as well as threshold studies. The PI at Yale, Maruyama, will continue her work in supernova detection and explore synergies between IceCube and DM-Ice with Yale students and postdocs. Funding to support5 this work will be sought from NSF and other sources.