



DOE/NSF Joint G2 Direct Detection Dark Matter Program

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NSF/DOE G2 Process



The process of selecting second-generation direct dark matter experiments began almost three years ago with the recognition by both agencies that optimal utilization of national resources for the G2 DM program requires that NSF and DOE closely coordinate their selections and funding plans.

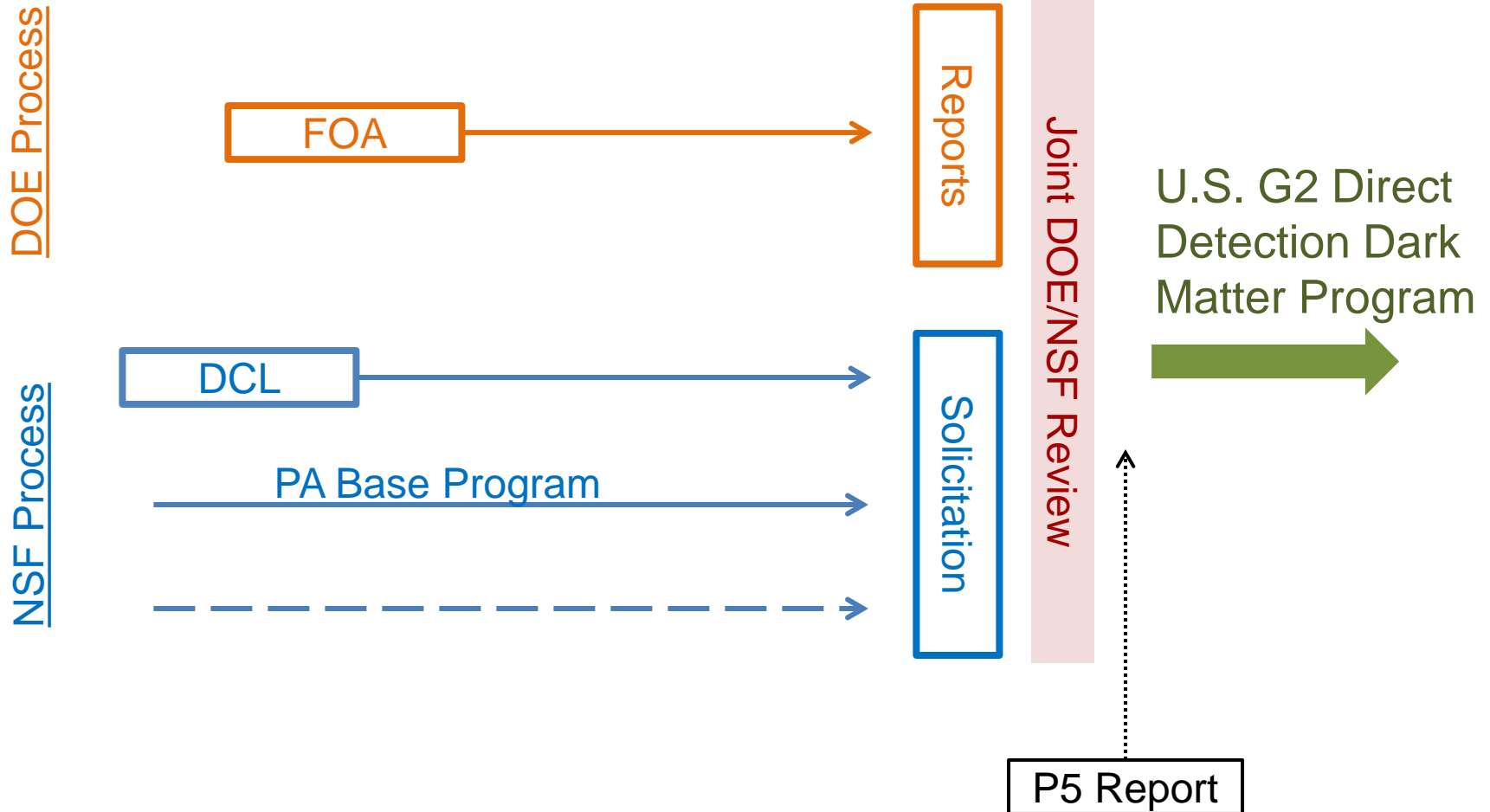
- Independent R&D-phase selections with other agency observing
- Independent solicitations, but coordinated requirements
- Final selection of experiment performed jointly: joint review panel; coordinated selections; optimized allocation of responsibilities to both agencies; joint management structure where appropriate.

Coordinated Multi-Phase Process



- **NSF – DCL 12-043:** In January 2012, NSF issued a Dear Colleague Letter calling for proposals related to the development of underground physics experiments. R&D awards were made for projects including direct detection dark matter experiments. DOE participated as observers. [See *J. Kotcher's March 2012 HEPAP Presentation.*]
- **DOE – DE-FOA-0000597:** In March 2012, DOE issued a Funding Opportunity Announcement soliciting proposals for R&D for second-generation dark matter experiments. Awards were made to ADMX-Gen 2, LZ, COUPP-500, SuperCDMS-SNOLAB, and DarkSide-G2. Only these experiments were eligible for possible future construction with DOE funds. NSF participated as observers. [See *M. Salamon's March 2013 HEPAP Presentation.*]
- **NSF Solicitation 13-597:** In August 2013, NSF issued a solicitation for second-generation Direct Detection Dark Matter (DDDM) Experiments. The solicitation was written in collaboration with DOE so that the proposals submitted to NSF would also satisfy the DOE reporting requirements.
- **DOE Down-selection:** Final R&D reports with updated conceptual designs were submitted to DOE and reviewed in the Joint DDDM Review.
- **Joint DDDM Review:** The review panel was jointly charged by both agencies and reviewed both NSF proposals and DOE reports. The panel provided recommendations to both agencies for a joint program.

NSF/DOE G2 DDDM Process



DDDM Review Criteria



The following criteria were considered in the review and selection of DDDM projects:

1. Importance of the proposed experiment within the context of the current and projected future national and international dark matter research efforts.
2. Completeness of the flow-down from science goals to experiment performance requirements.
3. Capacity of the experiment to meet its performance requirements along with the potential scientific power of the experimental method.
4. Completeness of the identification of current technical risks, and feasibility of the plan for technical risk reduction. The increased risk associated with methods incorporating less mature technologies may be offset by the promise of potentially superior science capabilities.
5. Realism of project cost and schedule.

P5 Recommendations



“The experimental challenge of discovery and characterization of dark matter interactions with ordinary matter requires a multi-generational suite of progressively more sensitive and ambitious direct detection experiments. This is a highly competitive, rapidly evolving field with excellent potential for discovery. The second-generation direct detection experiments are ready to be designed and built, and should include the search for axions, and the search for low-mass (<10 GeV) and high-mass WIMPs. Several experiments are needed using multiple target materials to search the available spin-independent and spin-dependent parameter space. This suite of experiments should have substantial cross-section reach, as well as the ability to confirm or refute current anomalous results. Investment at a level substantially larger than that called for in the 2012 joint agency announcement of opportunity will be required for a program of this breadth.”

Recommendation 19: Proceed immediately with a broad second-generation (G2) dark matter direct detection program with capabilities described in the text. Invest in this program at a level significantly above that called for in the 2012 joint agency announcement of opportunity.

U.S. Portfolio of G2 Direct Detection Dark Matter Investments



The U.S. portfolio of G2 direct detection dark matter investments will include the following:

- **LUX-Zeplin (LZ)** and **Super CDMS – SNOLAB** for their collective sensitivity to both low and high-mass WIMPS
- **ADMX-Gen2** to search for Axions
- Coordinated efforts in **R&D** to test and develop a broad range of technologies for future experiments

Current Direct Detection Dark Matter Projects



DOE Supported Projects:

ADMX-IIa

Joint DOE/NSF Supported Projects:

COUPP-60

DARkSide-50

LUX

SuperCDMS – Soudan

NSF Supported Projects:

ADMX-HF

DRIFT-II

PICASSO

XENON100

XENON1T

U.S. Portfolio of G2 Direct Detection Dark Matter Investments



Result is a joint US portfolio of investments in Direct Detection Dark Matter experiments. The selections were made jointly. Both agencies will make significant investments in the portfolio. The agencies will jointly-manage and/or coordinate the construction and operations of the selected experiments and the R&D program.

P5 recommendations on the scientific and technical breadth of the program are addressed through the selected projects and the R&D program. Planned funding levels are responsive to P5 recommendations, but are contingent upon budget appropriations.

Projected Budgets and Timelines



Budgets and project timelines are still being determined and will depend on the final budget allocations. The agencies are working with the project leadership to implement the projects expeditiously. Funding for ADMX-Gen2 began in FY2014. Funding for LZ and SuperCDMS-SNOLAB is expected to begin in FY2015.

No dedicated solicitations for R&D proposals are planned. Proposals should be submitted under the general program solicitations. R&D funding will be coordinated between the two agencies.



We appreciate the efforts of the community throughout this process and we are looking forward to very exciting science!