DARWIN: project overview

Laura Baudis
6th DARWIN meeting

Naples, December 9-11, 2013

University of Zurich[UZH]

The DARWIN Consortium

29 groups from 9 countries

The past: 2010 - 2013

Funded through the first Aspera common call
Final report was submitted in summer 2013

Milestone number	Date	Milestone Name	Deliverable
0	January 2010	First general DARWIN meeting; discussions on the organisation of the work for each WP	Website (public and internal)
1	March 2010	Postdocs hired: INFN, CH, F, Netherlands	
	(within 2010)	WPs have been set up	
2	September 2010	Second general DARWIN meeting: presentations and discussions of interim results for each WP	Online reports on the progress in all WPs (on Darwin internal site)
3	April (May) 2011	First year report	Delivered to Aspera
4	September 2011	Third general DARWIN meeting: presentations of the technical report for each WP	Online reports on the progress in all WPs
5	May 2012	Second year report	No second year report was required by Aspera
		Publications of results in refereed journals	
6	September 2012	Fourth general DARWIN meeting: presentations from each WP	Online reports on the progress in all WPs
7	July 2013	Final report to Aspera	Technical report: to be submitted by end of 2013

Scientific merit

- Dark matter exists, and WIMPs are still excellent candidates for dark matter
- WIMP masses: 1 GeV - 100 TeV and cross sections: 10^{-40} - 10^{-50} cm^2
- If a WIMP is discovered by a ton or multi-ton scale experiment, we must measure the recoil spectrum with high statistics, to extract the mass and cross section

  ➡ Dark matter identification: one of the highest science priorities

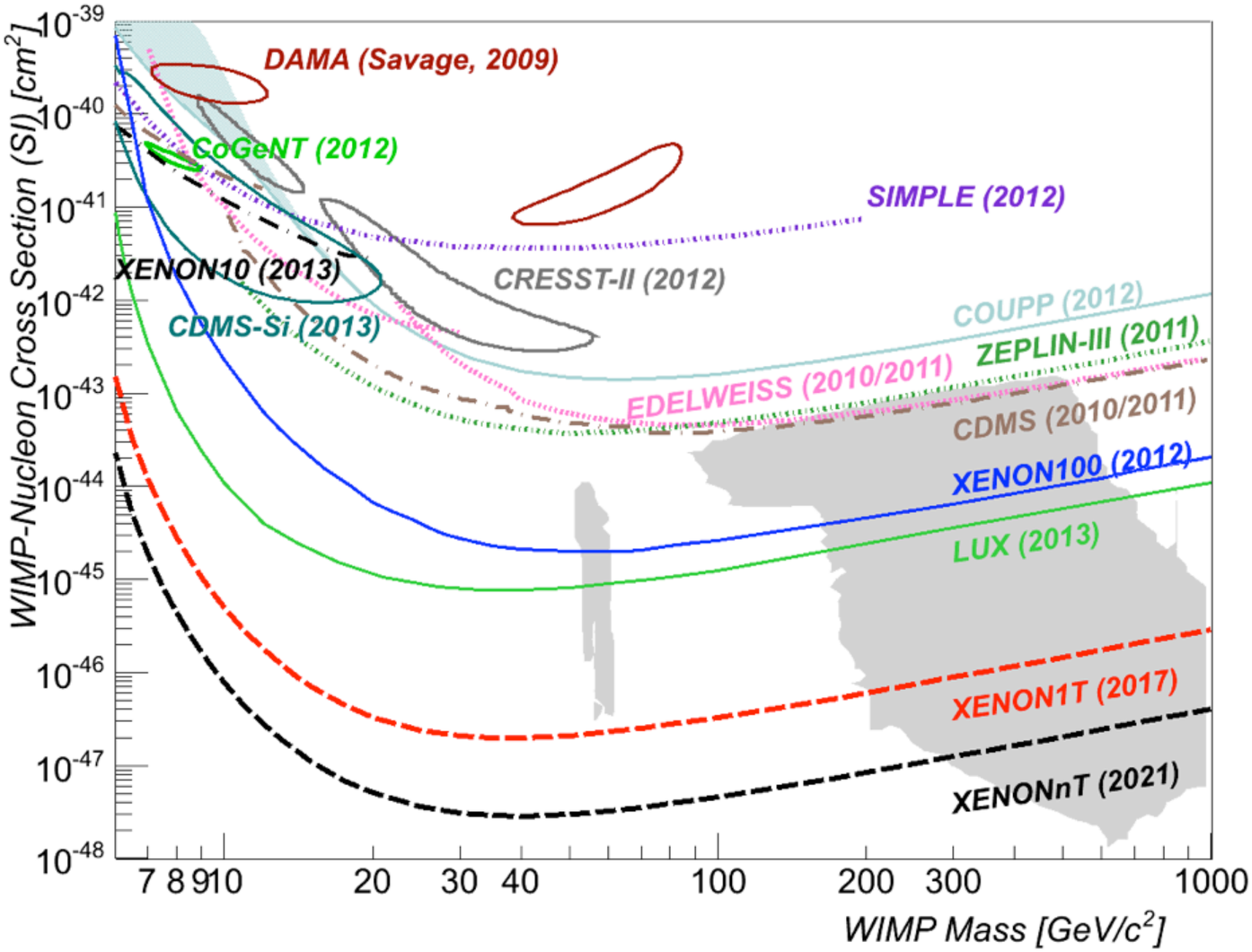
- Other physics: axion and ALP searches, double beta decay of ^{136}Xe, low-energy solar neutrinos, coherent neutrino scattering

Dark matter experiments with strong European involvement

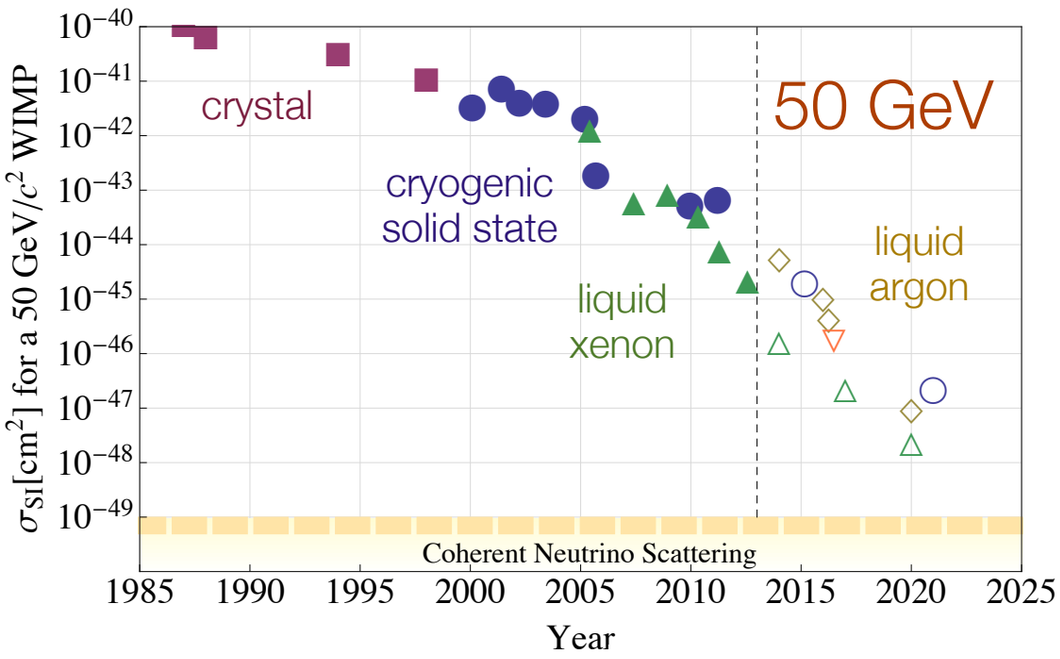
- Bolometers:
  - ➡ current: CRESST, EDELWEISS
  - ➡ future: EURECA (proposal, CDR), discussions with SuperCDMS towards > 100 kg
- Noble liquids:
  - ➡ current: ArDM, DarkSide-50, XENON100, and XENON1T (in construction)
  - ➡ future: DarkSide5t (proposal), XENONnT (n=5-7, proposal), DARWIN (design study funded by ASPERA 2010-2013)
- Room temperature crystals:
  - ➡ DAMA/LIBRA, ANAIS (in construction)
- Directional: R&D, large detector(s) (1 ton CF_4 at 50 torr for 10^{-46} cm^2 ~ 16 x16 x16 m^3) once there is a clear discovery
  - ➡ DMTPC, DRIFT, MiMAC

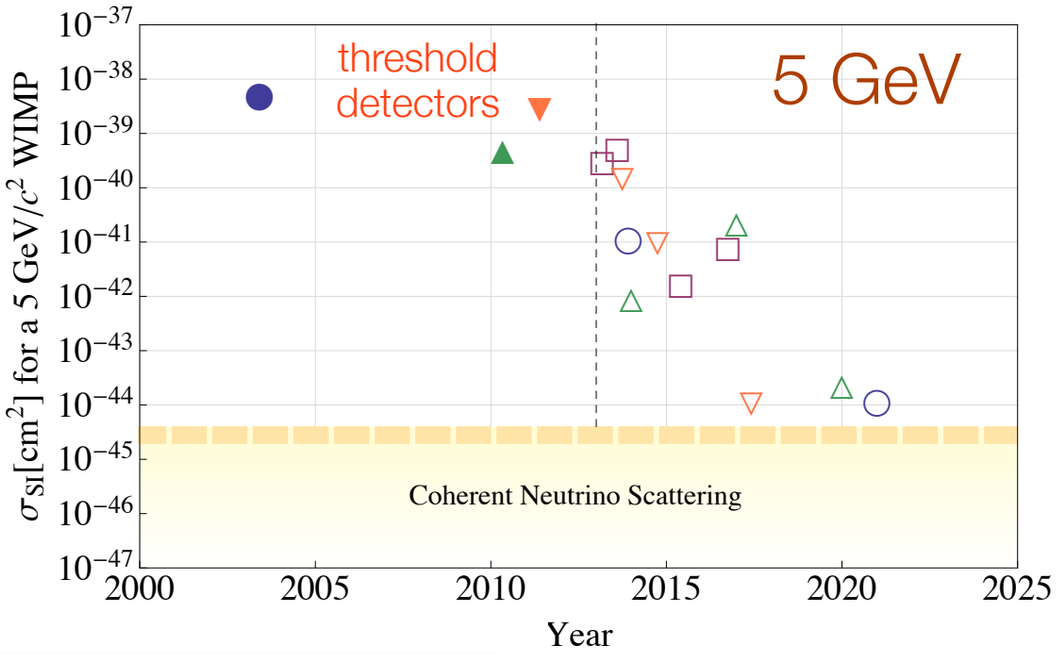
Status of the field: LXe

- Recent results for SI interactions (LUX, Oct 2013), and XENON1T/XENONnT goals



Evolution of the WIMP-nucleon cross section





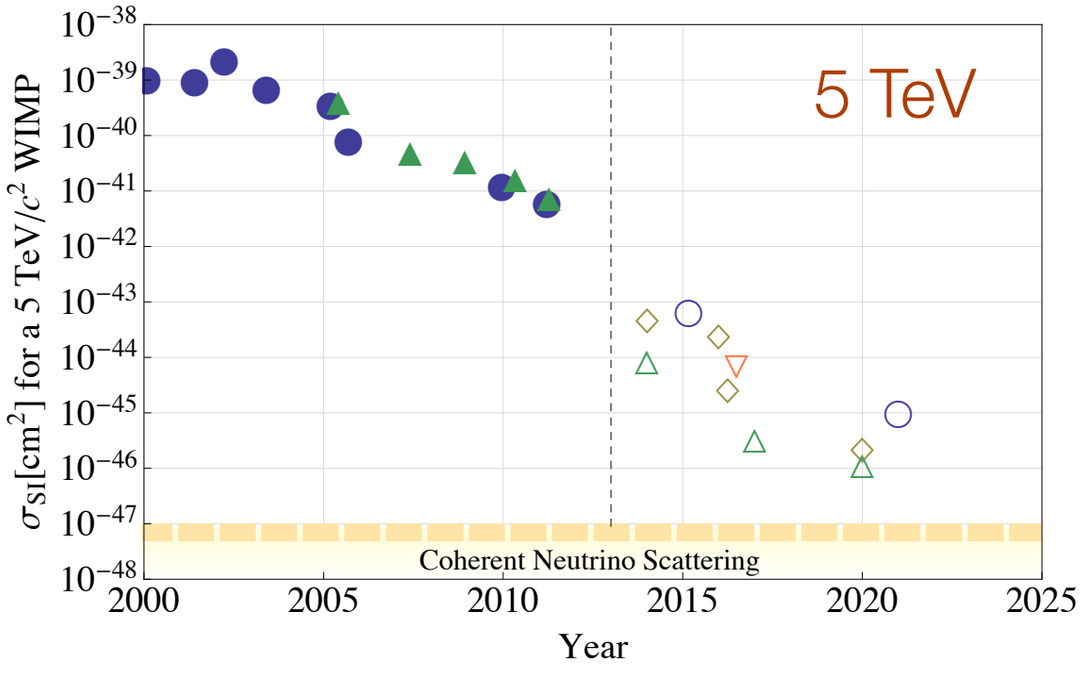
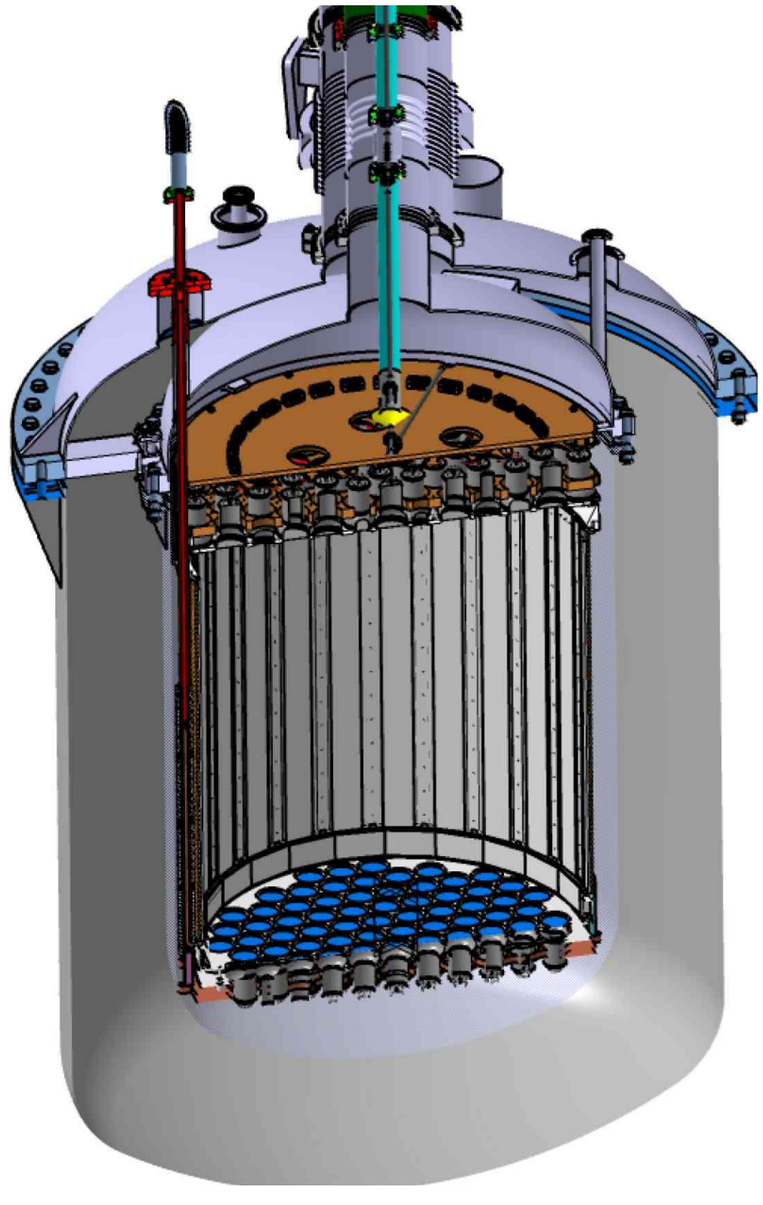


Figure 1. *History and projected evolution with time of spin-independent WIMP-nucleon cross section limits for a 50 GeV WIMP. The shapes correspond to technologies: cryogenic solid state (blue circles), crystal detectors (purple squares), liquid argon (brown diamonds), liquid xenon (green triangles), and threshold detectors (orange inverted triangle). Below the yellow dashed line, WIMP sensitivity is limited by coherent neutrino-nucleus scattering.*

Status of the field: LXe (Europe)

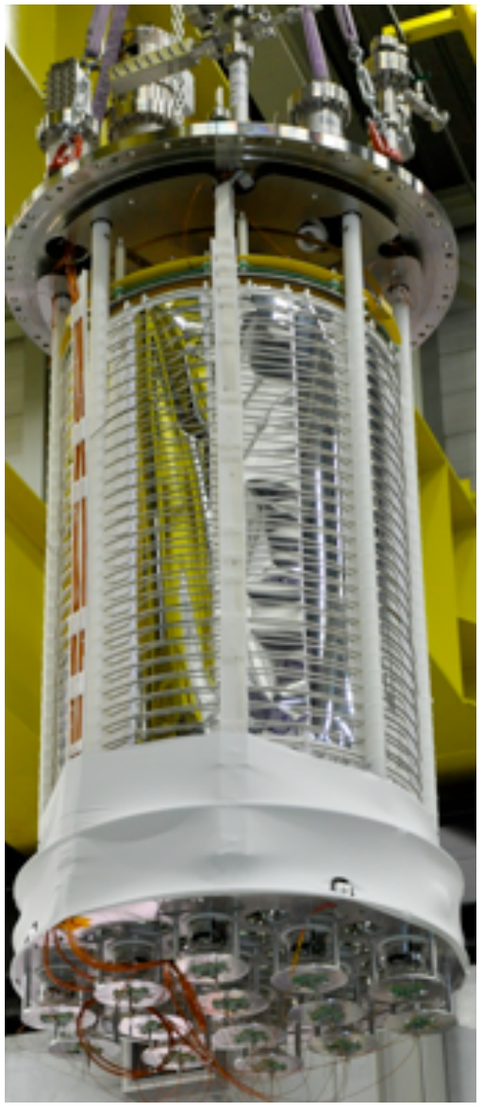
- XENON1T well under construction at LNGS, and XENONnT is planned/proposed

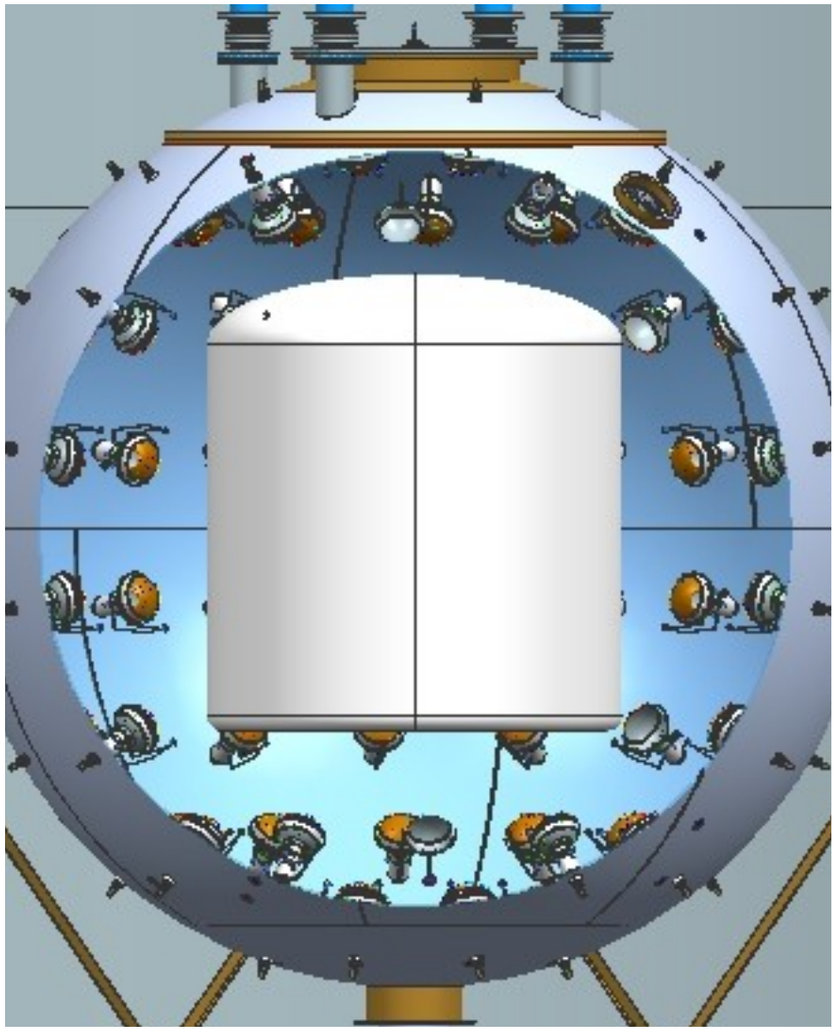


XENON1T outer cryostat and Xe storage system such that up to several tons of Xe can be accommodated in XENONnT

Status of the field: LAr (Europe)

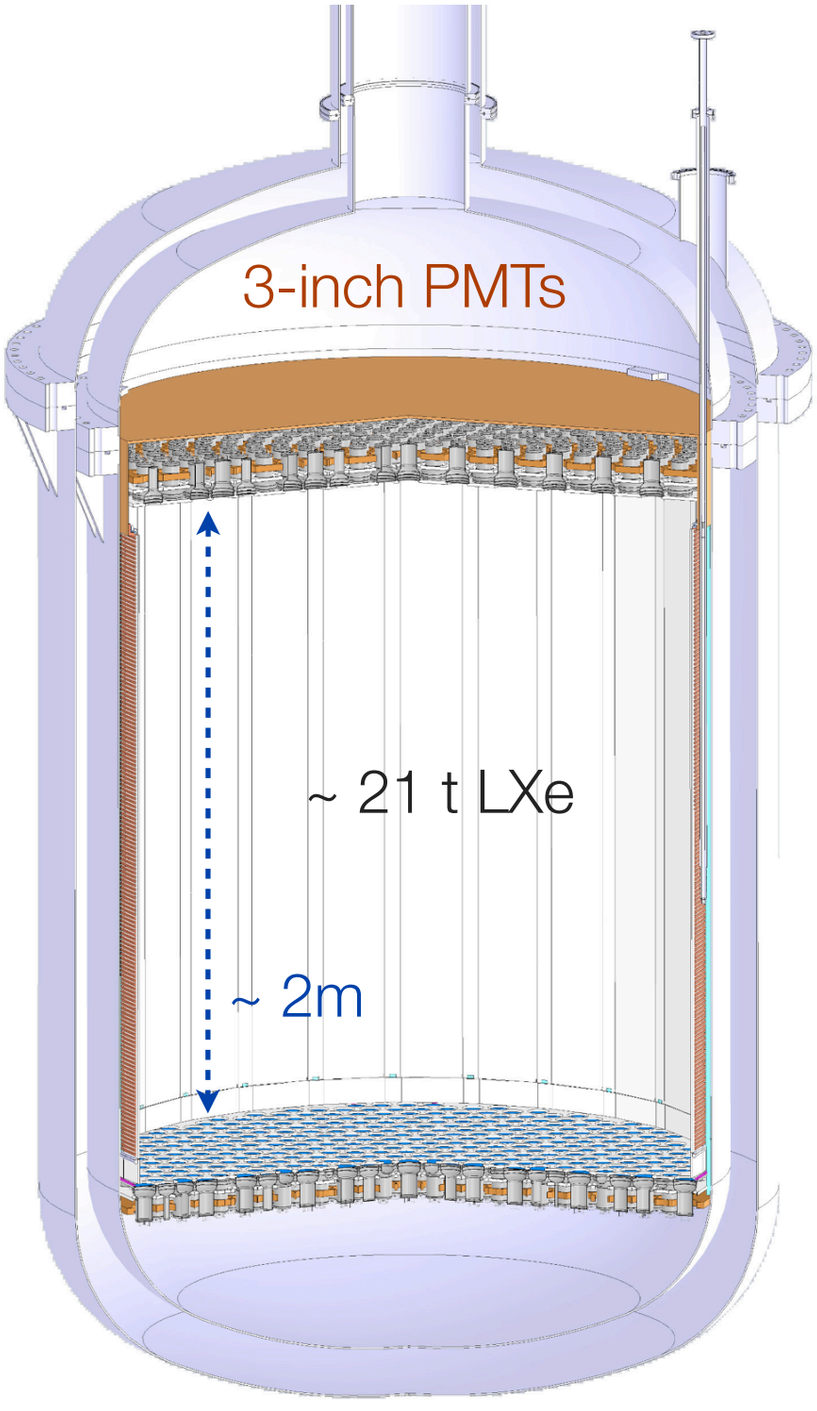
- DarkSide-50 (operating), ArDM (commissioning) and DarkSide-5t (proposed)

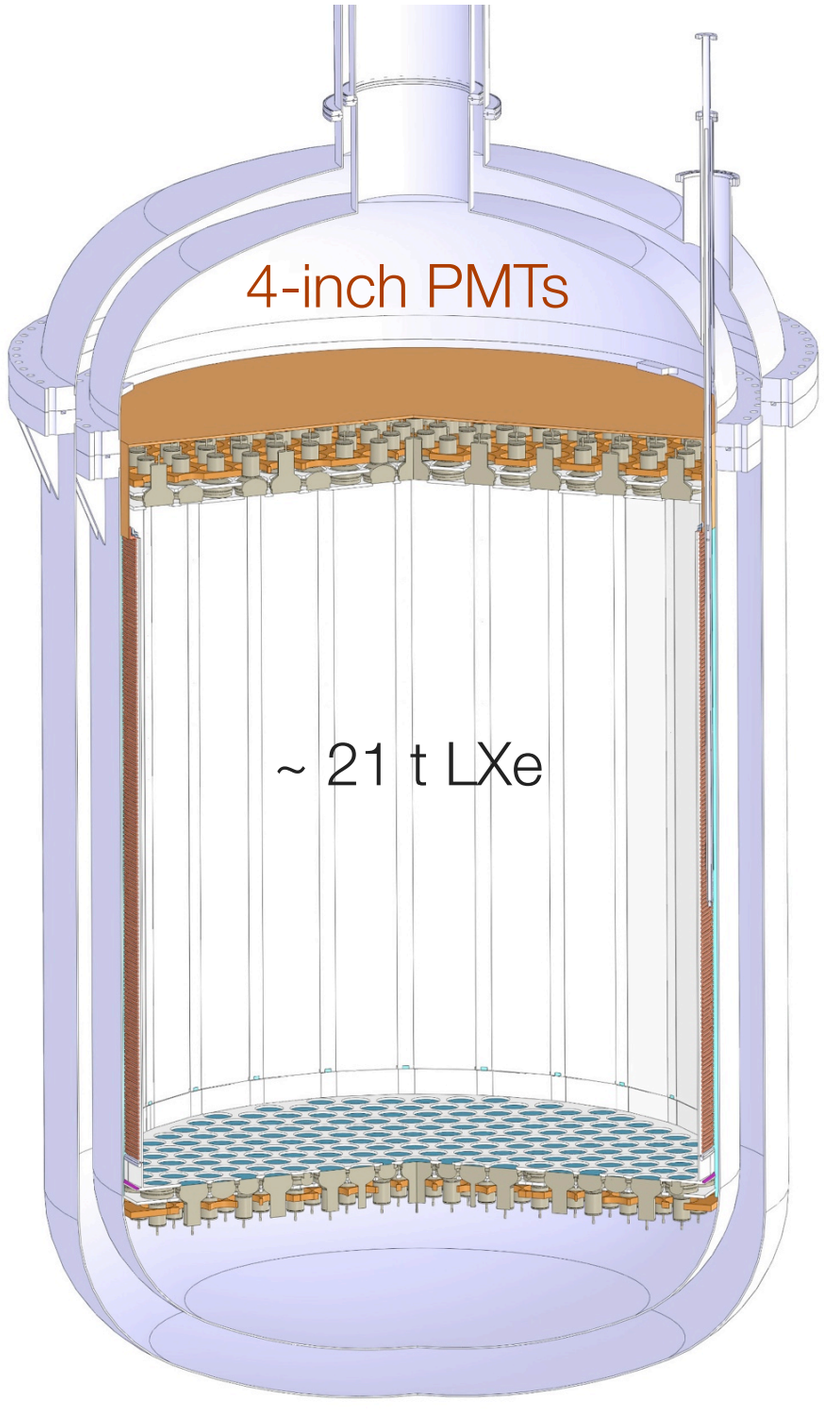




Update on DARWIN (possible) detector design (LXe part)

- TPC: 2 m drift, PTFE walls with Cu field rings
  - ➡ 5 grids
  - ➡ HV ~ 100-200 kV
- 3-inch PMTs
  - ➡ 397 top
  - ➡ 475 bottom
- 4-inch PMTs
  - ➡ 207 top
  - ➡ 253 bottom





Development Plan of 4-inch PMT for Dark Matter Experiments

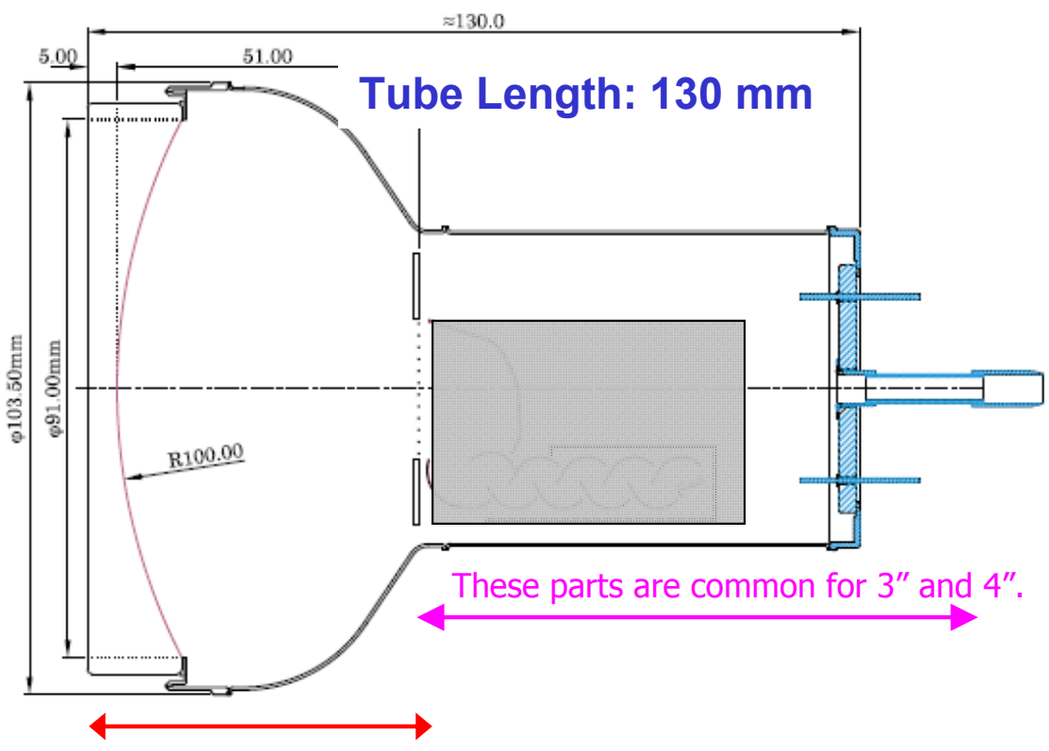
Nov. 13 2013

New 4-inch PMTs by Hamamatsu?

HAMAMATSU
PHOTON IS OUR BUSINESS

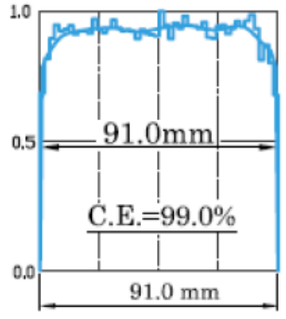
Drawing of 4-inch PMT

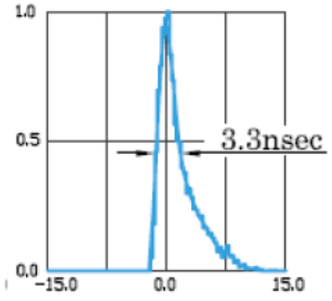
Diameter: 104 mm
Effective Area: 91 mm



400 nm

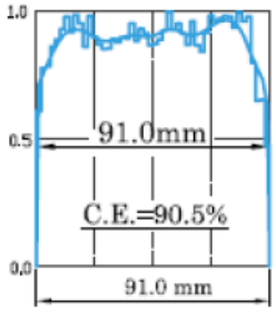
Uniformity T.T.S. C.E.

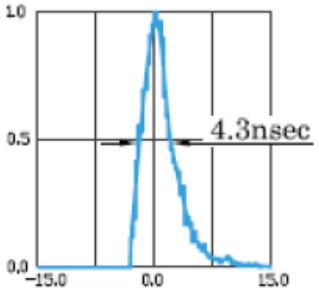




99.0%

175 nm

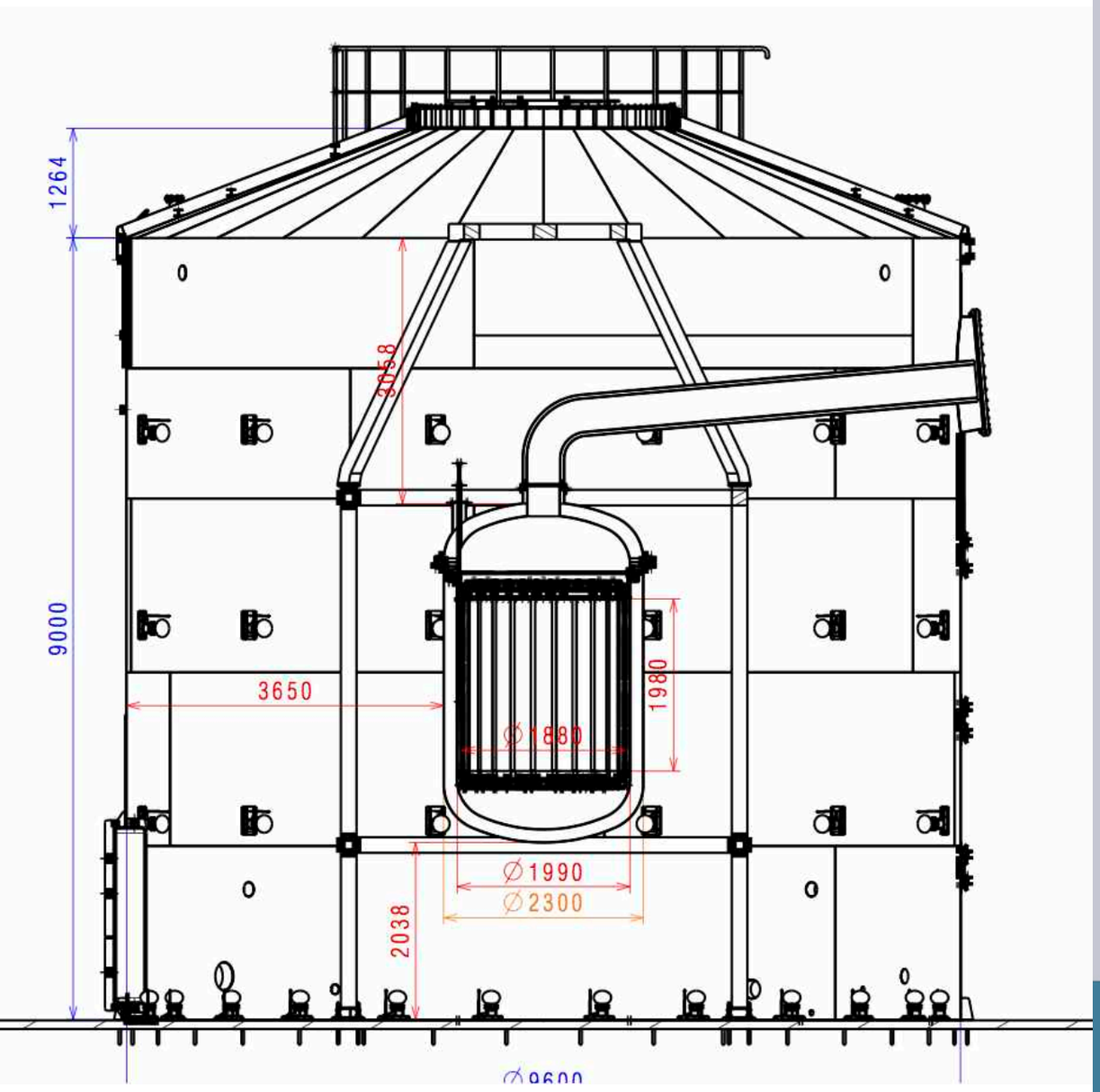


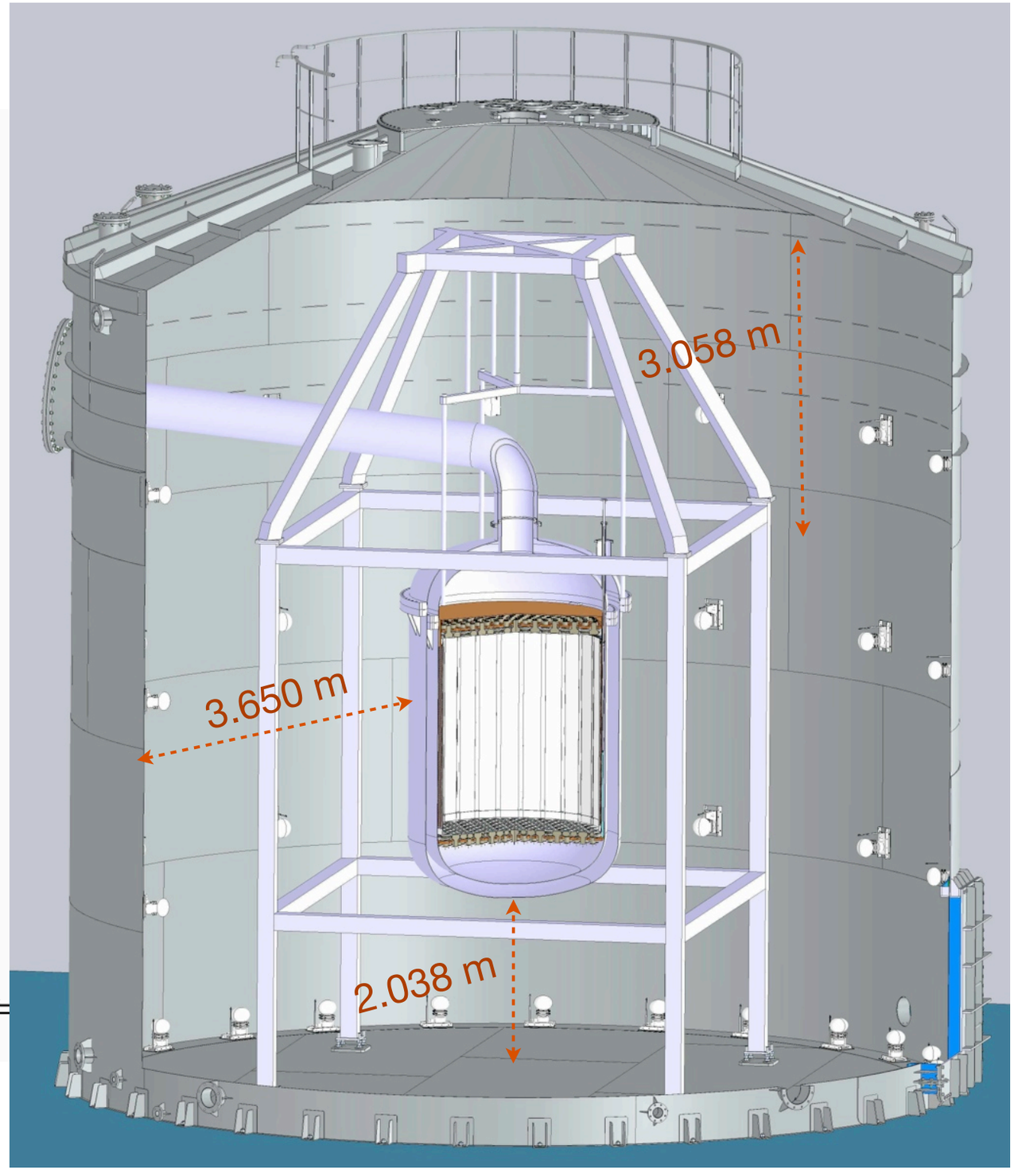


90.5%

CONFIDENTIAL

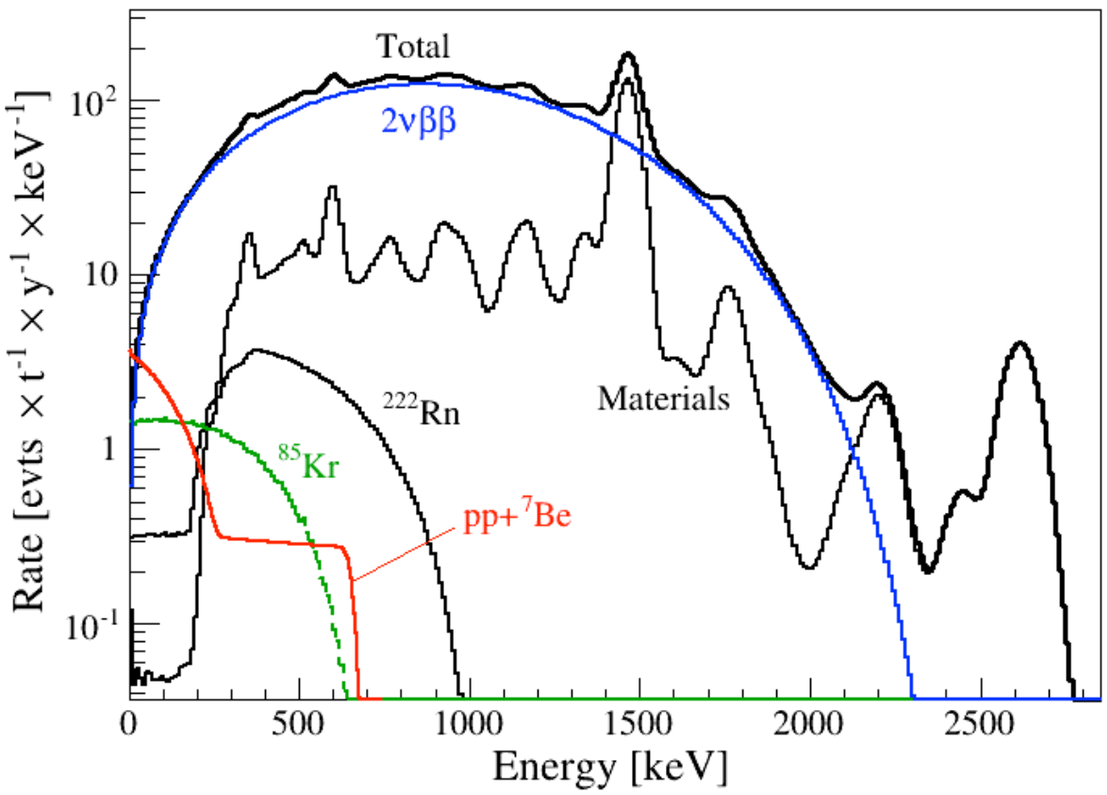
DARWIN cryostat in XENON1T water tank

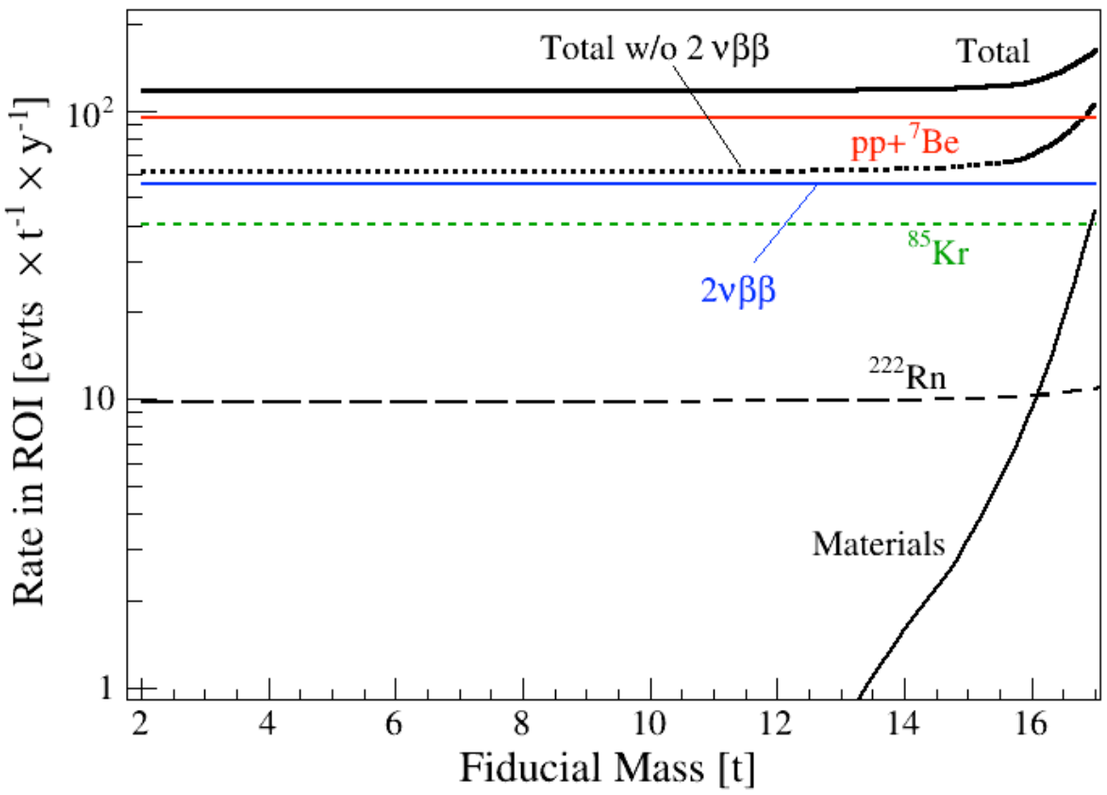




Backgrounds

- From detailed MC simulations (see talk by A. Kish)
- Dominated by solar neutrinos and 2-neutrino double beta decays
- Assumptions: 0.1 ppt of ^{nat}Kr, 0.1 μBq/kg ^{222}Rn

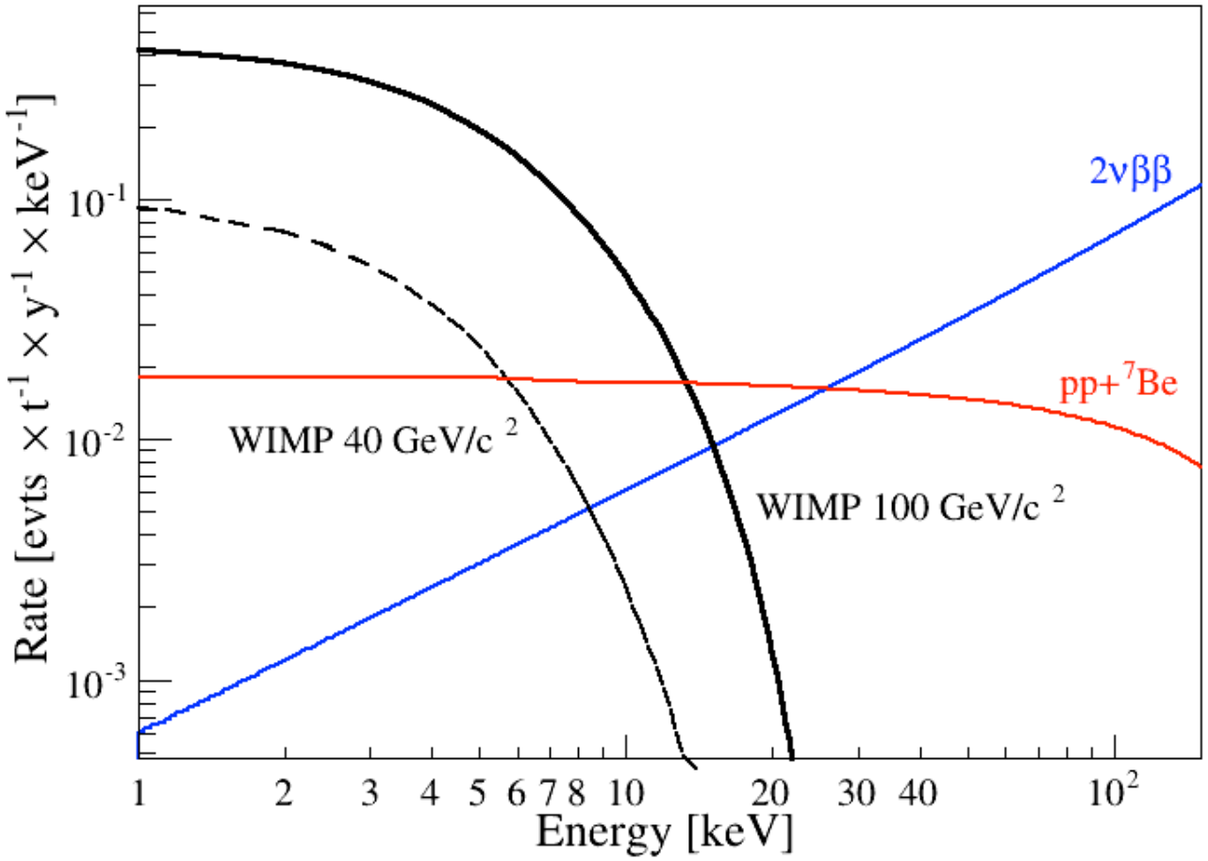


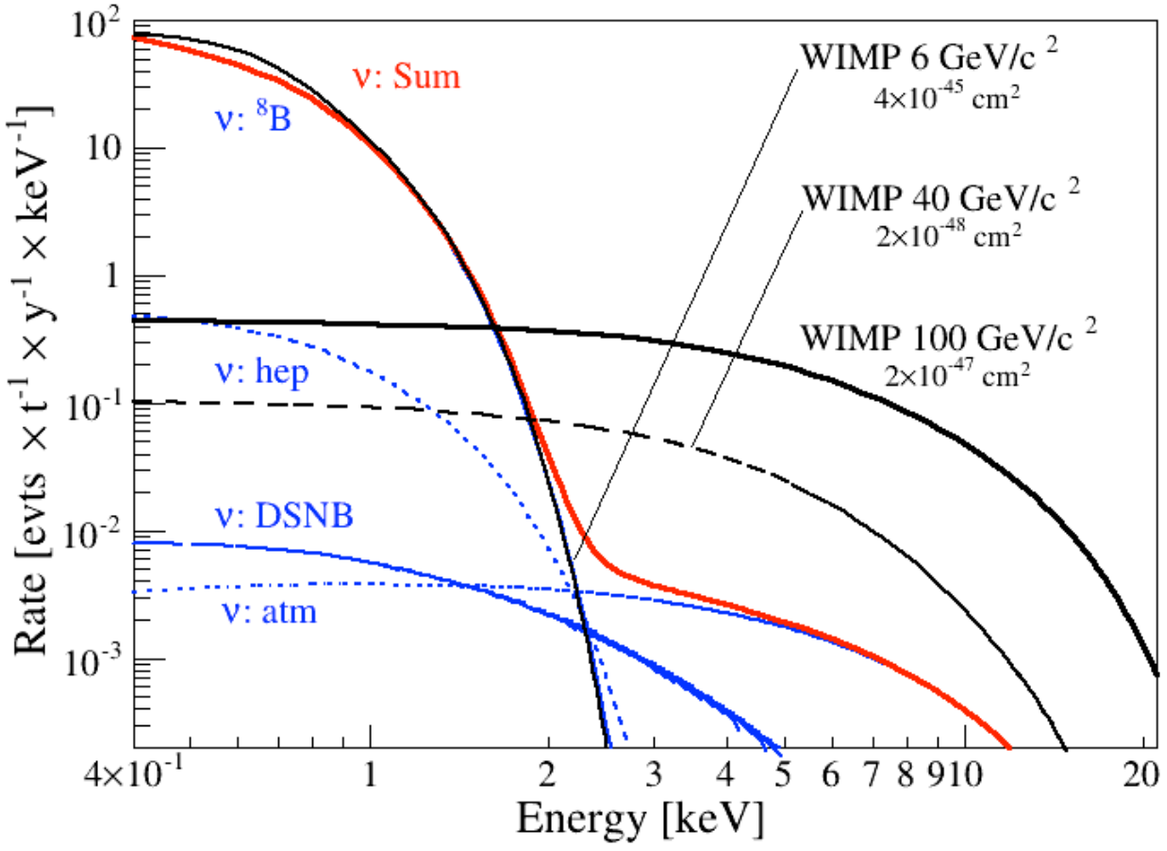


arXiv:1309.7024

Backgrounds and WIMPs

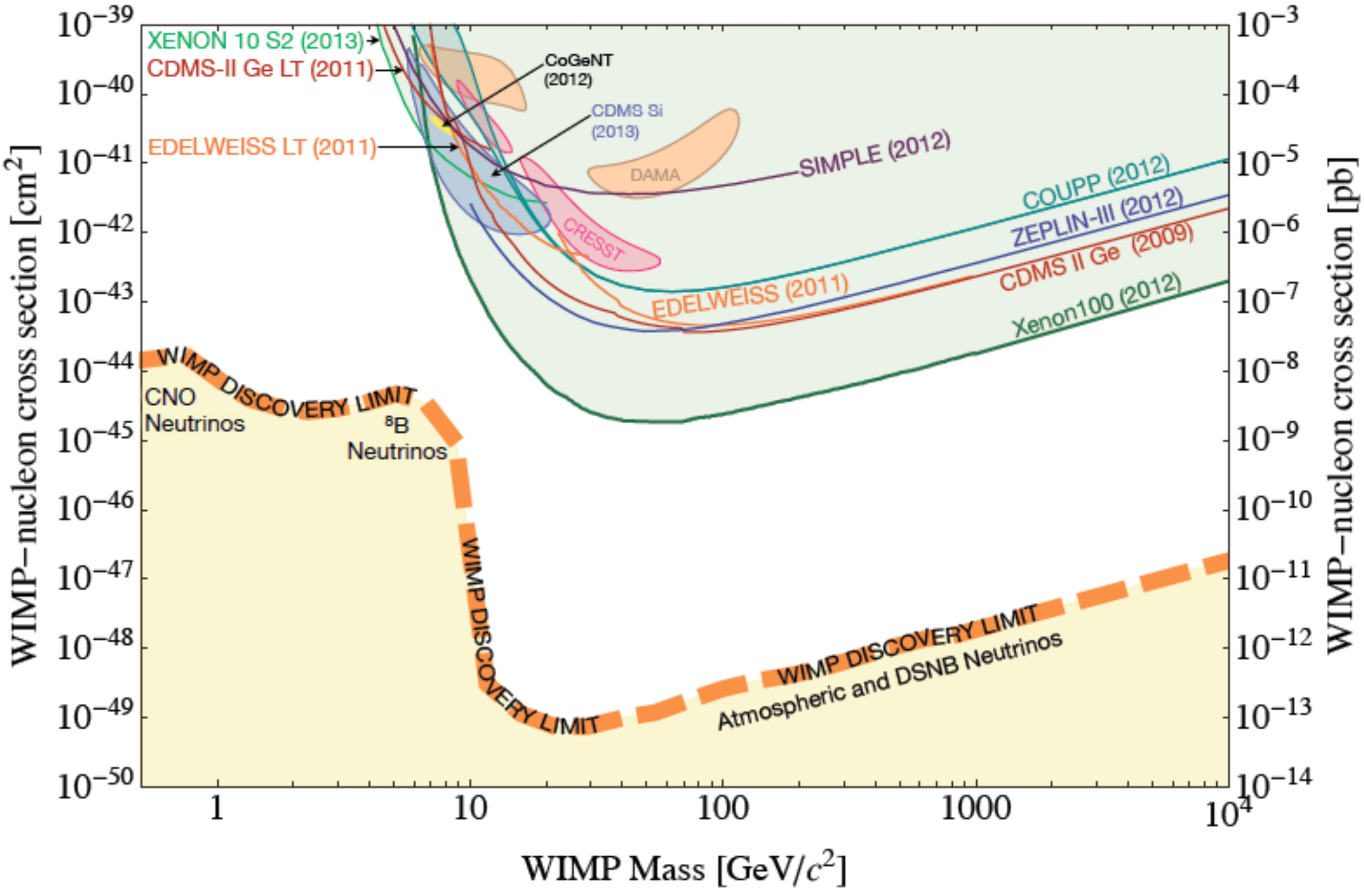
- A WIMP with a mass of 40 GeV (100 GeV) and sigma=2×10^{-48} cm^2 (2×10^{-47} cm^2) is well above the solar neutrino background
- A WIMP with a mass of 6 GeV and sigma=4×10^{-45} cm^2 has a similar rate as ^{8}B neutrinos



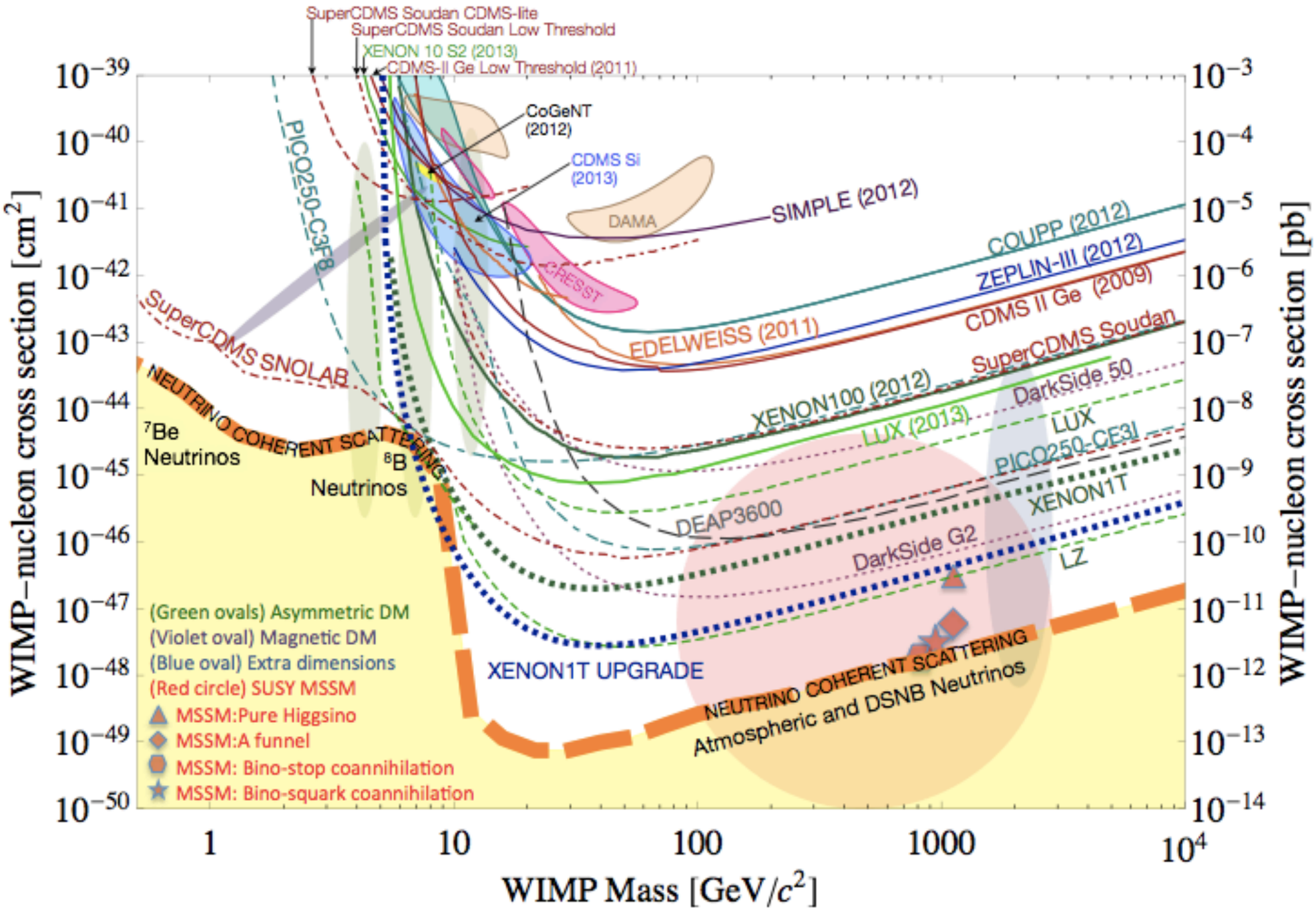


arXiv:1309.7024

Available parameter space for WIMPs



Available parameter space for WIMPs



DARWIN and UED

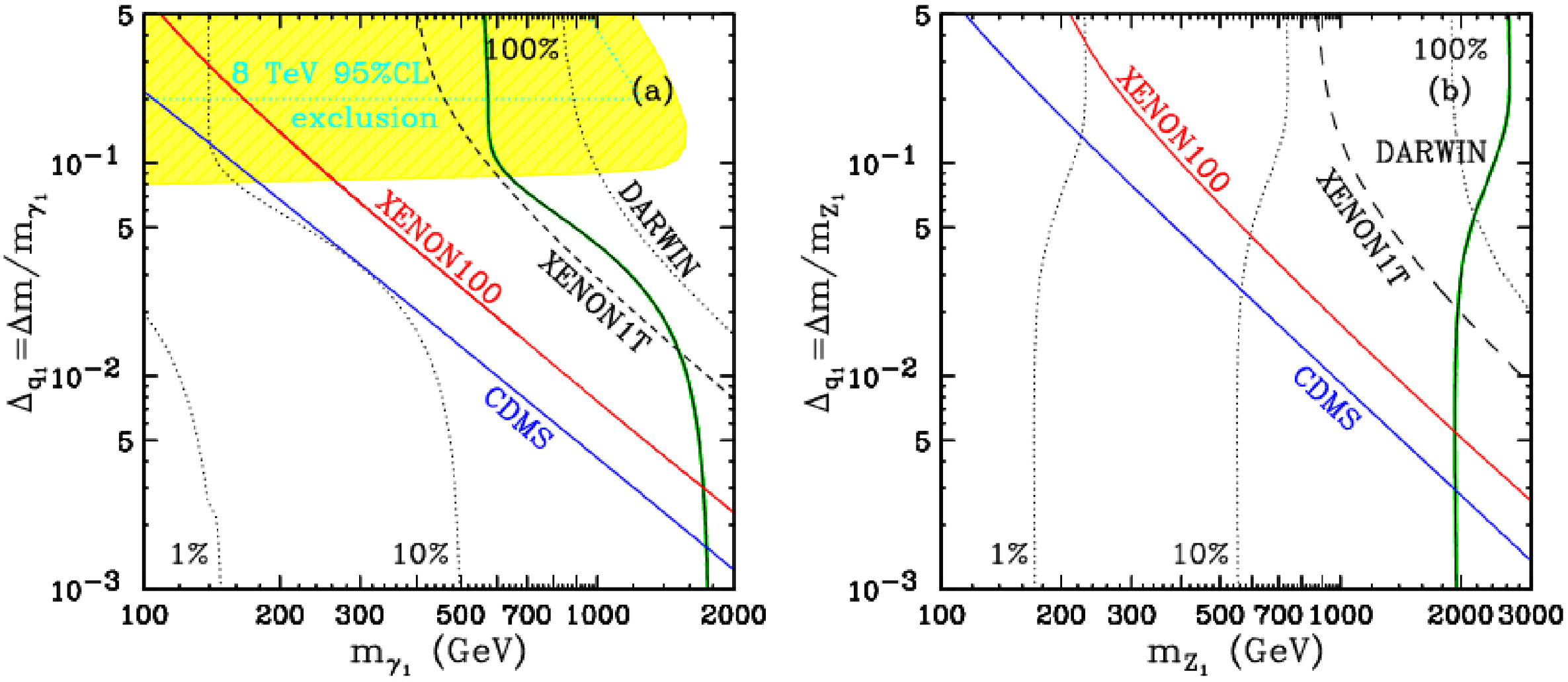


FIG. 8: *Combined plot of the direct detection limit on the spin-independent cross section, the limit from the relic abundance and the LHC reach for (a) γ_1 and (b) Z_1, in the parameter plane of the LKP mass and the mass splitting Δ_{q_1}. The remaining KK masses have been fixed as in Ref. [224] and the SM Higgs mass is $m_h = 125\,GeV$. $\Lambda R = 20$ is assumed. The black solid line accounts for all of the dark matter (100%) and the two black dotted lines show 10% and 1%, respectively. The green band shows the WMAP/Planck range, $0.117 < \Omega_{CDM}h^2 < 0.1204$. The blue (red) solid line labelled by CDMS (XENON100) shows the current limit of the experiment whereas the dashed and dotted lines represent projected limits of future experiments. In the case of γ_1 LKP, a ton-scale experiment will rule out most of the parameter space while there is little parameter space left in the case of Z_1 LKP. The yellow region in the case of γ_1 LKP shows parameter space that could be covered by the collider search in the $4\ell + \not{E}_T$ channel at the LHC with a luminosity of 100 fb^{-1} [223]. (Figures taken from [221].)*

News from APPEC

- First SAC meeting took place in Paris, October 2013
- APPEC Horizon2020 meeting at DESY/Zeuthen in November 2013
- Information about funding possibilities and future calls
- First call is to be issued December 11

Excellent Science
31,73% i.e. 22,27 B euros

- A: Marie Skłodowska Curie Actions (MSCA)
- B: Frontier research (ERC)
- C: Research infrastructures (RI)
- D: Future and Emerging Technologies (FET)

News from APPEC

- Proposed funding, 2014 - 2020, in million Euro

European Research Council (ERC) Frontier research by the best individual teams	**13 095**
Future and Emerging Technologies Collaborative research to open new fields of innovation	**2 696**
Marie Skłodowska-Curie actions (MSCA) Opportunities for training and career development	**6 162**
Research infrastructures *(including e-infrastructure)* Ensuring access to world-class facilities	**2 488**

* All funding figures in this presentation are subject to the pending Multiannual Financial Framework Regulation by the EP and the Council

currently rate of success: 15%

ITN deadline April 2014, 350 ME, rate of success: 10%

INFRADEV design studies, Sept 2014, 15 ME

European Research Council (ERC)

- Starting Grant, researchers 2-7 years after award of PhD
- Consolidator Grant, for researchers 7 - 12 years after PhD
- Advanced Grant, for established researchers
- Program duration: 2014 - 2020, 7 years

➡ we should consider ERC funding within DARWIN

Research Infrastructures

- RI: the EC considers not only major scientific equipment to be RI but also includes sets of instruments, knowledge-based resources such as archives, databases etc, and enabling e-Infrastructures (grids, computing, software, communication infrastructure)
- Support for new infrastructures is normally limited to the planning phases of new infrastructures of pan-European interest identified by the “European Strategy Forum for Research Infrastructures” (ESFRI)
- Program duration: 2014 -2020, 7 years; one call per year is expected
- Example of funded projects: Laguna-LBNO design study, ET design study etc (http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=design_studies_fp7)

Horizon2020 funding opportunities

- 1. MSCA (Marie Sklodowska Curie Actions): ITN underground lab, deadline is April 2014
- 2. Design study for ESFRI: DARWIN? deadline is September 2014

- If we go ahead with 2, in which form?
- Suggested structure of DARWIN for such a proposal, emerging from the old structure

  ➡ we will need to define WP and TG leaders

WP1: detector and infrastructure

- Underground infrastructure
- Cryostat and cryostat support
- TPC structure, field cage
- Grid electrodes, HV and HV feedthroughs

WP2: liquid target

- Cooling system
- Purification system (for electronegative impurities)
- Multi-ton gas storage system
- Emergency recovery

WP3: signal detection (light and charge)

- PMTs and alternative photosensors
- Alternative charge readout
- Cold electronics
- Connectors, cables, feedthroughs

WP4: signal readout

- DAQ systems (signal amplification, digitization, warm electronics)
- Trigger and veto systems
- Data storage, handling, processing

WP5: Calibration

- Light calibration (LED + fiber system) and stability monitoring
- ER + NR band calibration
- Energy calibration
- Ly and Qy measurements, monoenergetic lines as anchor points

WP6: background

- Kr assay and removal system
- Rn assay and removal system
- Material screening (HPGe, ICP-MS, NAA) and Rn emanation
- Shield: mechanical aspects, water Cherenkov shield, liquid scintillator

7. Science

- MC simulations: backgrounds, light collection efficiency, signal modeling
- Sensitivity studies (WIMPs, axions and ALPs, neutrino channels)
- Statistical sensitivity analyses including astrophysical, nuclear uncertainties

DARWIN time schedule

2010 - 2013

First R&D phase, Aspera funded

June 2013: Aspera final report

2014 - 2018

Design studies

end 2014: proposal for design study
2015 - 2018
2018: CDR

2018 - 2020

Engineering studies

2018-19: demonstrators at home institutions

2020: TDR, proposals

2020 - 2030

Construction, commissioning, science run

2020: construction/integration at UL

2021: commissioning

2022: physics runs

DARWIN costs example (LXe part)

Item	Total costs [in 10^6 CHF]
Photosensors, 1000	7.0
Xenon, 30 t	22.5
Detector (TPC, grids, HV)	1.5
Cryostat	4.5
Cryostat support	0.5
Cherenkov shield	0.5
Water tank	0.4
Xenon storage	1.6
Infrastructure	1.4
Electronics, DAQ, cables	1.8
Calibration system	0.3
Slow control	0.3
Screening (HPGe, ICP-MS)	0.4
LXe purification (Rn, Kr)	1.5
Demonstrator vertical (drift, HV)	0.5
Demonstrator horizontal (grids)	0.5
Sum	**54.2**

End

DARWIN recommended by ApPEC

Christian Spiering, DESY

Open Symposium
European Strategy Preparatory Group
Krakow, Sept. 11, 2012

ApPEC
ASPERA Astroparticle Physics for Europe

Recommendations WIMP Dark Matter

- **With the advent of the LHC and thanks to a new generation of astroparticle experiments using direct and indirect detection methods, the <u>SUSY -WIMP dark matter hypothesis will be proven or disproven within the next 5-10 years.</u>**
- Stormy progress of LXe technology. XENON100 with record limits. XENON1T under construction.
- LAr technology attracts new interest using argon depleted in ^{39}Ar. Potential of technology will be demonstrated by DarkSide-50 (50 kt, LNGS, end 2012).
- **<u>SAC recommends that DARWIN (target mass of noble liquids up to 10-20 tons) is pursued and supported. Choice of double-target options after demonstration of LAr capabilities.</u>**

  Other potential capabilities of DARWIN: solar ν in real time, $0\nu\beta\beta$ decay with ^{136}Xe.
- Bolometric approach remained (nearly) competitive with noble liquids in sensitivity. EDELWEISS (Ge), CRESST ($CaWO_4$). CDMS in US. Need cross-check of possible signals in noble liquids!
- **<u>SAC supports development of EURECA (~1 ton sensitive mass) and the on-going cooperation with the CDMS follow-up projects.</u>**
- SAC supports R&D on directional detection, as a confirmation of the galactic character of potential positive detection by high-density target detectors
- SAC supports improving DAMA/LIBRA w.r.t. lower threshold and lower background to better understand the modulation. Fully independent experiment of same/similar technology is crucial.

DARWIN on the Swiss CHIPP Roadmap

Swiss Institute of Particle Physics

- The roadmap was also considered as a basis for the Swiss input to CERN‘s European Strategy and to ApPEC
- CHIPP signed the new ApEC MoU - in fact, SNF signed for CHIPP
    - Switzerland is now member of ApPEC: the ApPEC Secretary General has countersigned the document on behalf of ApPEC, just two weeks after the signing of the **accession document** by the Swiss National Science Foundation SNSF. This new membership is pleases in particular the ApP community within CHIPP, who has asked for this step in a **Resolution**(accepted by the CHIPP Board on 7 September 2013).

Recommendation 6 – Direct and Indirect Dark Matter Detection

CHIPP recommends that the necessary resources be provided for the construction, maintenance, operation and physics exploitation of the present generation XENON100, XENON1T and ArDM experiments for the direct detection of Dark Matter. The construction and operation of the DARWIN multi-ton Dark Matter search facility should receive an appropriate Swiss contribution.

Astroparticle Physics European Coordination

From ASPERA ad Futurum – signing of the MoU for the new ApPEC

The representatives of a number of national government agencies, partners in ASPERA-2, have come together on the 29th of June in Berlin, at the Magnus-Haus of the German Physical Society (DPG) for signing the Memorandum of Understanding of the new Astroparticle Physics European Consortium (ApPEC).

This consortium emanates from the Astroparticle Physics European Coordination committee founded in 2001 and operating under the same acronym until this Memorandum of Understanding enters into force. It is the outcome of the preparatory work carried out by a consortium of ministries' and agencies' representatives and of the intense work provided by the EU funded ERANETs ASPERA and ASPERA-2 (from 2006 to 2012) that paved the way through a series of funding mechanism studies, common roadmap elaborations, common calls for R&D proposals, and common outreach and communication endeavours.

CH has signed the new ApPEC MoU

ACCESSION

of a new legal entity to ApPEC and the MoU "For the Coordination in Astroparticle Physics in Europe", signed in Berlin on the 29-Jun-2012.

The Swiss National Science Foundation SNSF

hereby consents to become a Participating Institution to the MoU identified above and accepts all the rights and obligations of a Participating Institution starting 01-Jan-2013.

The GENERAL SECRETARY hereby certifies that the General Assembly has accepted in the meeting held on 29-Nov-2012 the accession of SNSF to the ApPEC MoU starting 01-Jan-2013.

SNSF is supporting the Swiss Institute of Particle Physics CHIPP in the coordination of the Astroparticle Physics area and will send a representative to the meetings of the ApPEC General Assembly. This representative will be accompanied by a scientist from the Astroparticle Physics area, at present Prof. Teresa Montaruli (University of Geneva). For personal reasons, Prof. Montaruli will be substituted by Dr. Mimmo della Volpe (University of Geneva) for the first six months of 2013.

The SNSF and CHIPP will contribute to the strategy definition of Astroparticle Physics in Europe and to outreach activities to enhance the field.

This Accession document has been done in 2 original copies to be duly signed by the undersigned authorized representatives.

Swiss National Science Foundation SNSF

Bern, 14 January 2013

Signature(s): .....

Name(s): *Paul Burkhard*

Title(s): *Head, Division Mathematics, Natural and Engineering sciences*
Swiss National Science Foundation

Astroparticle Physics European Consortium ApPEC

~~Brussels~~ Hamburg, 24.1.2013

Signature(s): .....

Name(s): Thomas Berghöfer

Title(s): Deutsches Elektronen-Synchrotron
Ein Forschungszentrum der Helmholtz-Gemeinschaft
Notkestraße 85 | 22607 Hamburg | Tel. 040 8998-0

News on FLARE (in CH)

SWISS NATIONAL SCIENCE FOUNDATION

- New SNF funding line for large infrastructure in astroparticle and particle physics
- In CH: CTA, DARWIN, LAGUNA
- Construction money will only be available starting in 2015
- We have submitted an LoI in November 15, 2012
- Results will be announced in the second half of March 2013

FLARE

The funding scheme FLARE (Funding LArge international REsearch projects) aims at facilitating the construction and maintenance of instrumentation for major international projects in particle physics, astrophysics and astroparticle physics. It replaces the hitherto existing schemes FORCE for particle physics (support of Swiss participations in CERN experiments, incl. operation, maintenance and computing on CERN's Large Hadron Collider LHC) and FINES for astronomy (support of Swiss instrument development for ESO). The new funding scheme FLARE also includes the support of the Swiss participation in ESFRI projects in the area of astroparticle physics.

For this purpose, CHF 26.5 million are made available to the SNSF for the 2013-2016 funding period.

To allow a reasonable continuation of the present scientific engagements by the scientific communities, there will be a transition period of 2 years between the current funding schemes FORCE and FINES, and the new scheme FLARE, before the definitive regulations will be made operational. This transition period allows taking into account that FLARE endorses 3 scientific communities which are organised in rather different manners. Furthermore, there are funding commitments made in the framework of the funding schemes FORCE and FINES which should be honoured until the SNSF has a clearer picture of the needs and long-term planning of the different communities, and better understands how the funding should be distributed amongst them.

Proposal submission and evaluation
National contact persons of eligible experiments can submit either a letter of intent ("LoI") or a full proposal to the SNSF.

The letter of intent ("LoI") describes an experiment where Swiss scientists plan to participate in the future (Roadmap). Submissions of these are intended to facilitate budget planning and management. Letters of intent include an experiment description as well as a detailed "business plan", consisting of a financial overview of the whole experiment and the planned deliverables and financial commitments of the Swiss participants over the duration of the experiment.

News from ASPERA/ApPEC

Dear Laura,

We just got started with the new APPEC. In total we are 13 partners including SNSF from Switzerland. You may have seen the press release of SNSF on joining APPEC. Some days ago we had the LAGUNA-LBNO community at DESY. I gave a presentation on what APPEC is doing and what the large projects can expect from APPEC. For the meeting starting tomorrow I will not be able to come to LNGS. But perhaps next time?

We have envisaged to do a reviewing of all large ApP projects. Details are not decided yet. At some point we may have a look at DARWIN, perhaps not in 2013. And in the first half of November we plan to do a large meeting for the whole community to inform and organize proposals for Horizon2020.

Best regards,
Thomas

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Update: time planning

Milestone number	Expected Date	Milestone Name	Deliverable
0	January 2010	First general DARWIN meeting; discussions on the organisation of the work for each WP	Website (public and internal)
1	March 2010 (within 2010)	Postdocs hired: INFN, CH, F, Netherlands WPs have been set up	
2	September 2010	Second general DARWIN meeting: presentations and discussions of interim results for each WP	Online reports on the progress in all WPs (on Darwin internal site)
2a	April (May) 2011	First year report	
3	September 2011	Third general DARWIN meeting: presentations of the technical report for each WP	Online reports on the progress in all WPs
3a	May 2012	Second year report Publications of results in refereed journals	Technical report
4	September 2012	Fourth general DARWIN meeting: presentations from each WP	Online reports on the progress in all WPs
4a	**End of May 2013**	**Final report**	Technical Design Study -> change to CDR

We will discuss later today - we will submit a final report at the end of May 2013, and a CDR by the end of this year?

Update on WP1

- **Executive Board:** responsible for assuring the day-to-day follow-up of the program; consists of the project coordinator and the leaders of the eight work packages. Responsible for implementing the design study work packages tasks.
- **L. Baudis, P. Decowski, G. Fiorillo, A. Rubbia, H. Simgen, D. Thers, C. Weinheimer**

  ➡ deliverables: one report per year, of all the activities -> we will write the final report due end of May

- **Project Management Group:** Responsible for all management decisions of the consortium, for the approval of all documents and for the dissemination of information. Responsible for the communication and submission of financial reports to the participating national funding agencies. Responsible for monitoring and reviewing the performed work and progress and for implementing corrective actions where necessary.
- **C. Amsler, E. Aprile, K. Arisaka, L. Baudis, A. Breskin, P. Decowski, G. Drexlin, G. Fiorillo, C. Galbiati, L.M. Krauss, R. Lang, M. Lindner, U. Oberlack, A. Rubbia, M. Schumann, D. Thers, R. Trotta, C. Weinheimer, K. Zuber**

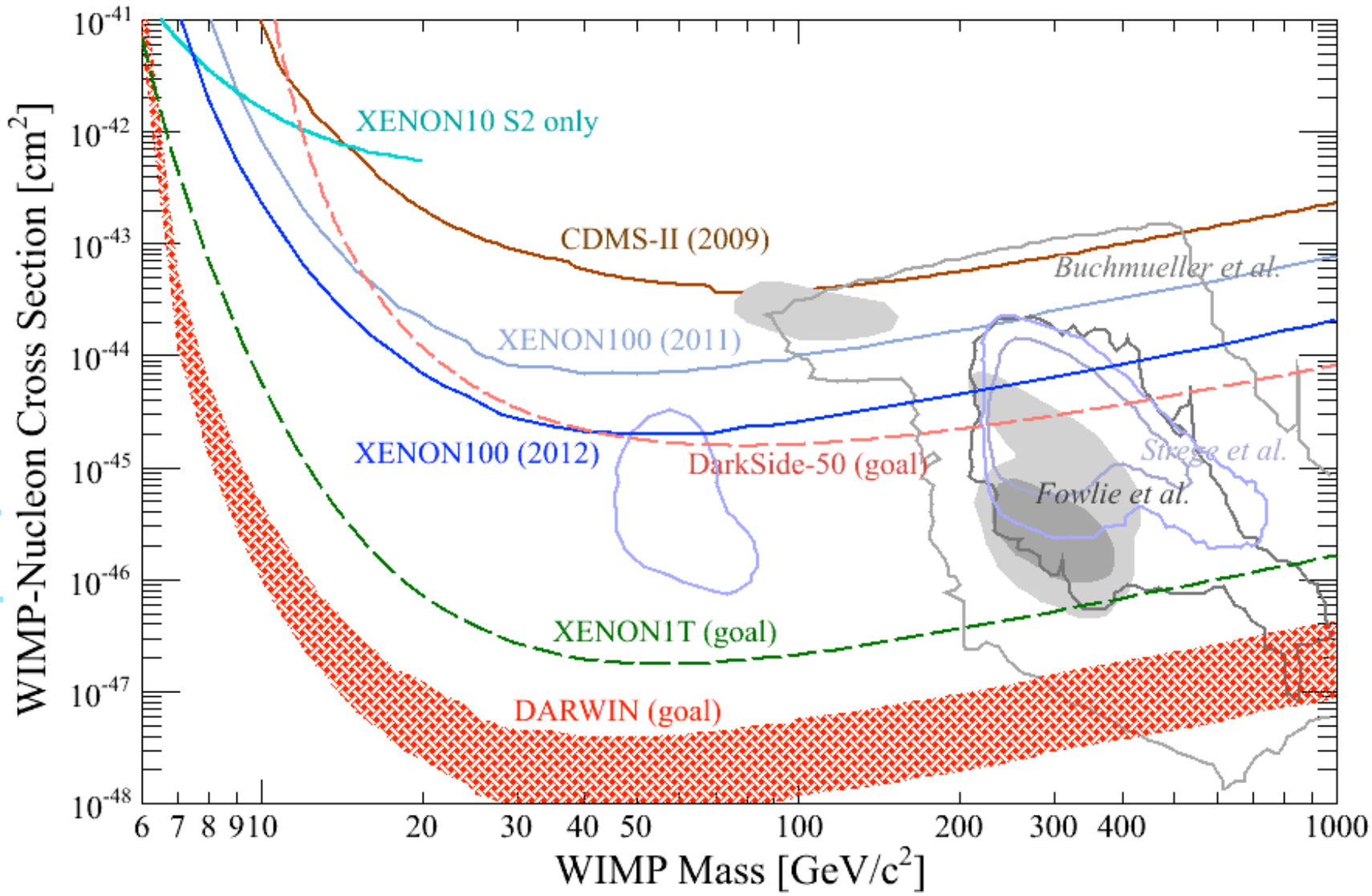
  ➡ we meet every few months (via skype)

  ➡ we also meet in person during the DARWIN general meetings

  ➡ new addition: Rafael Lang, Purdue, Marc Schumann, U Bern, Roberto Trotta, Imperial London

DARWIN dark matter sensitivity

- For a 50 GeV WIMP - a few x 10^{-48} cm^2



New WPs

- TPC and high-voltage
- Cryostat; cooling, recirculation and storage system
- Signal detection (light and charge)
- DAQ, electronics, trigger, data handling
- Calibration (energy, ER + NR bands, monitoring, Ly and Qy measurements, etc)
- Backgrounds (measurements, MC, Kr, Rn removal, veto systems, low-background materials)
- Science impact

Organization of WP2 (Detector Infrastructure)

- **WP coordinator: C. Weinheimer, Münster**

- **Task Group Coordinators:**

➡ **TG1 (cryostat and inner vessel):** Marc Schumann, Bern + Biaggio Rossi, Naples/Princeton

➡ **TG2 (cryogenic systems):** Biaggio Rossi, Naples/Princeton (Flavio Cavanna , L'Aquila?) + Wan-Ting Chen, Subatech

➡ **TG3 (liquid handling etc):** Christian Weinheimer, Münster

➡ **TG4 (HV systems etc)**: Uwe Oberlack, Mainz + Guido Drexlin, Karlsruhe Institute of Technology

Organization of WP3 (Light Readout)

- **WP coordinator: G. Fiorillo, INFN, Napoli**

- **Task Group Coordinators:**

➡ **TG1 (Photo detectors):** Teresa Marrodan, MPI-K

➡ **TG2 (UV light collection):** Ettore Segreto

➡ **TG3 (Light yield of low-energy NRs in LAr/LXe):** Christian Regenfus, UZH

Organization of WP4 (Alternative Charge Readout) - Micropatterns

DARWIN

- **WP coordinator: A. Rubbia, ETH Zürich, (A. Breskin, WIS ?)**

- **Task Group Coordinators:**

➡ **TG1 (large area thick GEMs):** Alessandro Curioni, ETHZ

➡ **TG2 (Gaseous PMs):** Lior Arazi, WIS

➡ **TG3 (GridPix):** Matteo Alfonsi, Nikhef

Organization of WP5 (Electronics, DAQ)

- **WP coordinator: D. Thers, Subatech**

- **Task Group Coordinators:**

➡ **TG1 (Low-noise electronics etc):** somebody from LNGS? Francesco Pietropaolo, CERN

➡ **TG2 (DAQ schemes):** Marc Schumann, Bern

➡ **TG3 (Computing Centre):** Jean-Pierre Cussonneau, Subatech

Organization of WP6 (Underground site, shielding)

- **WP coordinator: Uwe Oberlack, Mainz**

- **Task Group Coordinators:**

➡ **TG1 (LNGS investigations):** Flavio Cavanna, L'Aquila

➡ **TG2 (ULISSE investigations):** Luca Scotto Lavina, Subatech

➡ **TG3 (SunLAB investigations):** on hold, Polish groups may become active later on (?)

➡ **TG4 (backgrounds and shields):** somebody from Milano; Francesco Arneodo, LNGS +

➡ **TG5 (coordination and supply of large LAr/LXe quantities):** C. Galbiati (Alessandro Curioni, ETHZ)

Organization of WP7 (Material Screening, Backgrounds)

- **WP coordinator: Hardy Simgen, MPIK Heidelberg**

- **Task Group Coordinators:**

➡ **TG1 (Simulations of backgrounds from target and detectors impurities):** Alfredo Ferella, LNGS -> moved to science impact

➡ **TG2 (Database):** Patrick Decowski, Nikhef

➡ **TG3 (Material Screening):** Alfredo Ferella, LNGS

➡ **TG4 (Cryogenic Purification):** Hardy Simgen, MPIK

➡ **TG5 (Active vetoes):** Paolo Lombardi, Milano

Organisation of WP8 (Science Impact)

- **WP coordinator: P. Decowski, Nikhef**

- **Task Group Coordinators:**

➡ **TG1 (Scientific performance of the detector):** Aaron Manalaysay, UZH

➡ **TG2 (Complementarity between indirect, direct and accelerator searches):** Manfred Lindner, MPIK

➡ **TG3 (Impact on Astrophysics):** Lawrence Krauss, ASU

➡ **TG4 (Simulations of backgrounds from target and detectors impurities):** Andrey Aleksandrov (Naples), Alfredo Ferella (and Alex Kish), UZH