The Hidden Universe of Weakly Interacting Particles

Paul de Jong (UvA)
Patrick Decowski (UvA)
Sascha Caron (RU)
Wim Beenakker (RU)
Alexey Boyarsky (UL)
Ronald Bruijn (UvA)
Auke-Pieter Colijn (UvA and UU)
Aart Heijboer (Nikhef)
Maarten de Jong (Nikhef)
Els Koffeman (UvA)
Dorothea Samtleben (Nikhef and UL)
Christoph Weniger (UvA)

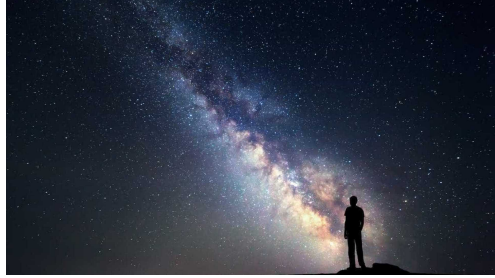
Nikhef
Universiteit van Amsterdam
Radboud Universiteit
Universiteit Leiden
Universiteit Utrecht

The Hidden Universe of Weakly Interacting Particles

How do neutrinos get mass, and do they contribute to the matter-antimatter asymmetry?

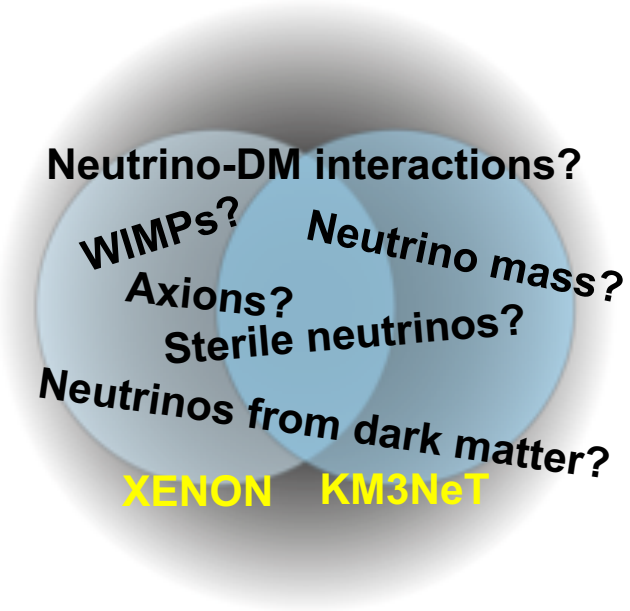
What is the nature of dark matter?

The Hidden Universe of Weakly Interacting Particles

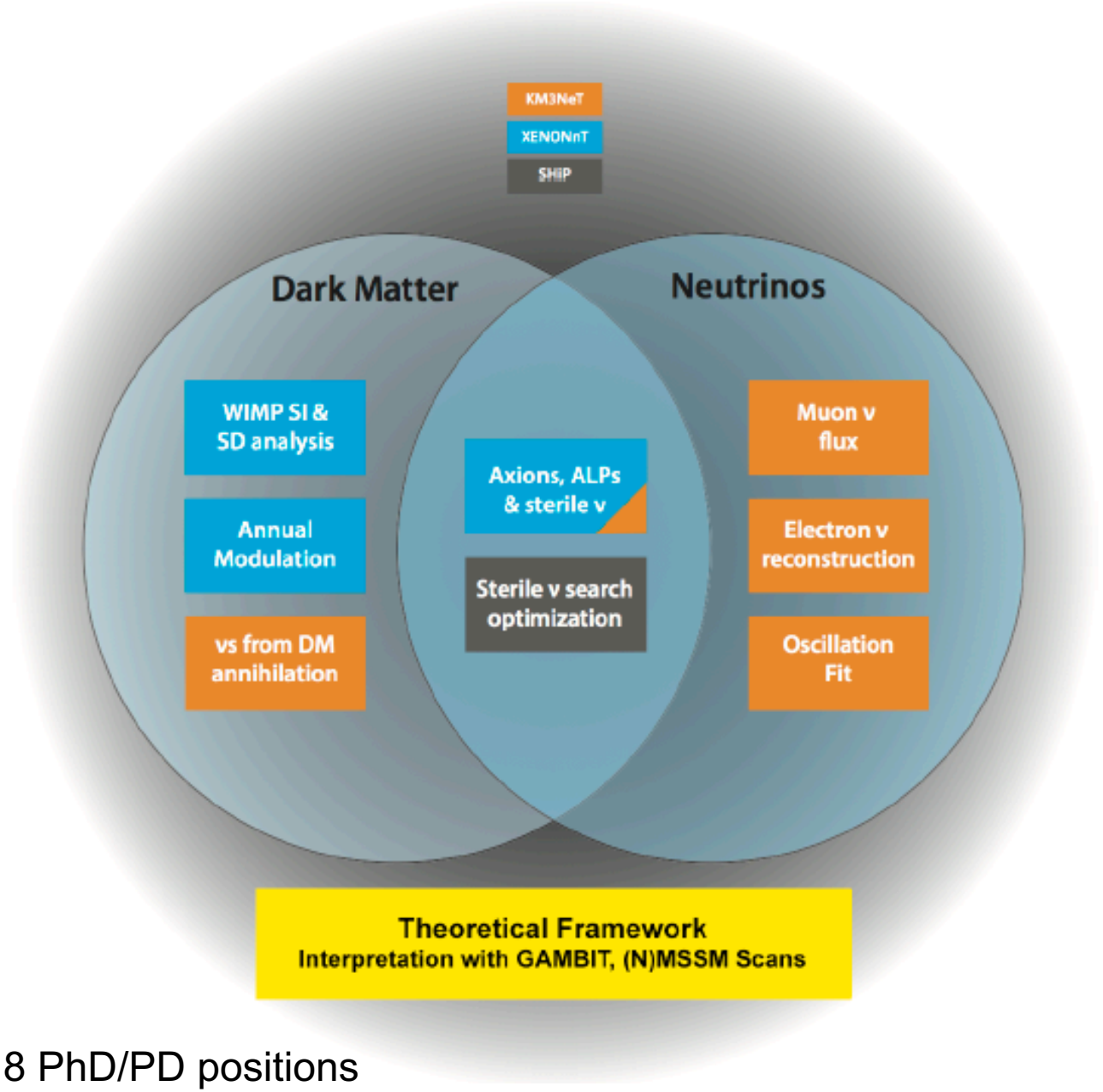


Three objectives:

- First determination of the neutrino mass hierarchy, using measurements of oscillations of atmospheric neutrinos (WP1)
- First detection of dark matter particles (WP2)
- Investigation of the relationship between neutrinos, dark matter, and physics beyond the Standard Model, in a broad theoretical and experimental framework (WP3)



Exciting experimental infrastructures are becoming available <u>now</u>



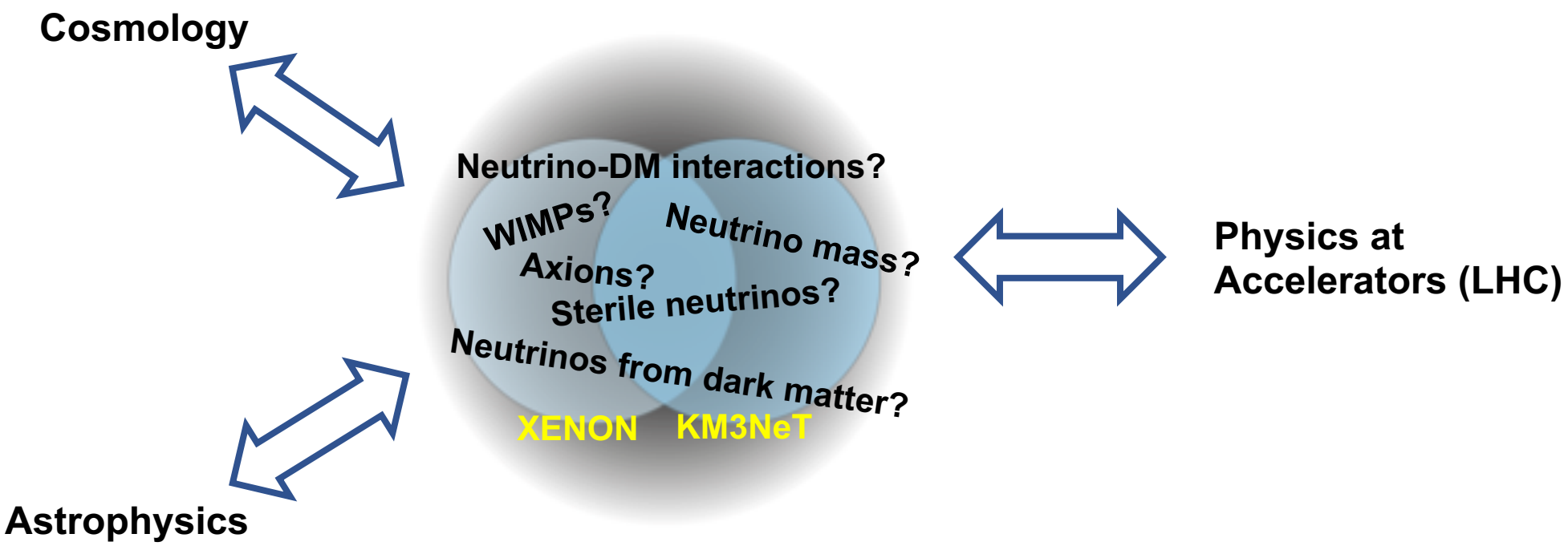
3 Work Packages
10 Projects
Request funding for 8 PhD/PD positions

WP	Project	2019	2020	2021	2022	2023	2024
1	KM3NeT	Muon neutrino flux [PhD]					
			Electron neutrino reconstr. [PD]				
			Oscillation fit [PhD]				
2	XENONnT	WIMP SI and SD analysis [PhD]					
		Axions, ALPs and sterile neutrinos [PhD]					
			Annual modulation [PD]				
	KM3NeT		Neutrinos from DM annihilation [PhD]				
3	SHiP		Sterile neutrino search optimization [PhD]				
	GAMBIT		Sterile neutrino BSM fit [PD]				
	SUSY-DM		DM fit and interpretation [PhD]				

Table 1: Timeline of the proposed projects. One PhD position in KM3NeT and one in XENON are not requested from NWO, but are matched by Nikhef.

WP3: Synthesis, interpretation framework and future experiments

Coherent and integrated view of the role of weakly interacting particles in our Universe



Bring Dutch theory and experiment together (neutrino-dark matter forum).

A single experiment will not answer the nature of neutrinos or dark matter alone.

PHYSICAL REVIEW D **96,** 042004 (2017)

Effective field theory search for high-energy nuclear recoils using the XENON100 dark matter detector

E. Aprile,[1] J. Aalbers,[2] F. Agostini,[3,4] M. Alfonsi,[5] F. D. Amaro,[6] M. Anthony,[1] F. Arneodo,[7] P. Barrow,[8] L. Baudis,[8] B. Bauermeister,[9] M. L. Benabderrahmane,[7] T. Berger,[10] P. A. Breur,[2] A. Brown,[2] E. Brown,[10] S. Bruenner,[11] G. Bruno,[3] R. Budnik,[12] L. Bütikofer,[13,*] J. Calvén,[9] J. M. R. Cardoso,[6] M. Cervantes,[14] D. Cichon,[11] D. Coderre,[13,*] A. P. Colijn,[2] J. Conrad,[9,†] J. P. Cussonneau,[15] M. P. Decowski,[2] P. de Perio,[1] P. Di Gangi,[4] A. Di Giovanni,[7] S. Diglio,[15] G. Eurin,[11] J. Fei,[16] A. D. Ferella,[9] A. Fieguth,[17] W. Fulgione,[3,18] A. Gallo Rosso,[3] M. Galloway,[8] F. Gao,[1] M. Garbini,[4] C. Geis,[5] L. W. Goetzke,[1] Z. Greene,[1] C. Grignon,[5] C. Hasterok,[11] E. Hogenbirk,[2] R. Itay,[12,‡] B. Kaminsky,[13,*] S. Kazama,[8] G. Kessler,[8] A. Kish,[8] H. Landsman,[12] R. F. Lang,[14] D. Lellouch,[12] L. Levinson,[12] Q. Lin,[1] S. Lindemann,[11,13] M. Lindner,[11] F. Lombardi,[16] J. A. M. Lopes,[6,§] A. Manfredini,[12,‖] I. Maris,[7] T. Marrodán Undagoitia,[11] J. Masbou,[15] F. V. Massoli,[4] D. Masson,[14] D. Mayani,[8] M. Messina,[1] K. Micheneau,[15] A. Molinario,[3] K. Morå,[9] M. Murra,[17] J. Naganoma,[19] K. Ni,[16] U. Oberlack,[5] P. Pakarha,[8] B. Pelssers,[9] R. Persiani,[15] F. Piastra,[8] J. Pienaar,[14] V. Pizzella,[11] M.-C. Piro,[10] G. Plante,[1] N. Priel,[12] L. Rauch,[11] S. Reichard,[14] C. Reuter,[14] A. Rizzo,[1] S. Rosendahl,[17] N. Rupp,[11] J. M. F. dos Santos,[6] G. Sartorelli,[4] M. Scheibelhut,[5] S. Schindler,[5] J. Schreiner,[11] M. Schumann,[13] L. Scotto Lavina,[20] M. Selvi,[4] P. Shagin,[19] M. Silva,[6] H. Simgen,[11] M. v. Sivers,[13,*] A. Stein,[21] D. Thers,[15] A. Tiseni,[2] G. Trinchero,[18] C. Tunnell,[2,22] M. Vargas,[17] H. Wang,[21] Z. Wang,[3] Y. Wei,[8] C. Weinheimer,[17] J. Wulf,[8] J. Ye,[16] and Y. Zhang.,[1]

(XENON Collaboration)[¶]

B. Farmer[9,**]

[1]*Physics Department, Columbia University, New York, New York 10027, USA*

[2]*Nikhef and the University of Amsterdam, Science Park, 1098XG Amsterdam, Netherlands*

"The impact of close collaboration between experimentalists, phenomenologists and theorists has never disappointed"

MNRAS **000**, 1–21 (2017) Preprint 23 November 2017 Compiled using MNRAS LaTeX style file v3.0

The SUrvey for Pulsars and Extragalactic Radio Bursts II: New FRB discoveries and their follow-up

S. Bhandari,[1,2,3]* E. F. Keane,[4,1,2] E. D. Barr,[9,1,2] A. Jameson,[1,2] E. Petroff,[5,1,2,3] S. Johnston,[3] M. Bailes,[1,2] N. D. R. Bhat,[2,10] M. Burgay,[11] S. Burke-Spolaor,[6,7] M. Caleb,[2,12] R. P. Eatough,[9] C. Flynn,[1,2] J. A. Green,[3] F. Jankowski,[1,2] M. Kramer,[9,15] V.Venkatraman Krishnan,[1,2] V. Morello,[9,1] A. Possenti,[11] B. Stappers,[15] C. Tiburzi,[16] W. van Straten,[1,17] I. Andreoni,[1,2,8] T. Butterley,[29] P. Chandra,[13] J. Cooke,[1] A.Corongiu,[11] D.M. Coward,[21] V. S. Dhillon,[15,27] R. Dodson,[24] L. K. Hardy,[14] E.J. Howell,[21] P. Jaroenjittichai,[30] A. Klotz,[22,23] S. P. Littlefair,[15] T. R. Marsh,[28] M. Mickaliger,[15] T. Muxlow,[15] D. Perrodin,[11] T. Pritchard,[1] U. Sawangwit,[30] T. Terai,[25] N. Tominaga,[19,31] P. Torne,[9] T. Totani,[20] A. Trois,[11] D.Turpin,[22,23] Y. Niino,[26] R. W. Wilson,[29] The ANTARES Collaboration.†

El 22 Nov 2017

Journal of Cosmology and Astroparticle Physics
An IOP and SISSA journal

Global analysis of the pMSSM in light of the Fermi GeV excess: prospects for the LHC Run-II and astroparticle experiments

Gianfranco Bertone,[a] Francesca Calore,[a] Sascha Caron,[b,c] Roberto Ruiz,[d] Jong Soo Kim,[e] Roberto Trotta[f,g] and Christoph Weniger[a]

[a]GRAPPA, University of Amsterdam,
Science Park 904, 1090 GL Amsterdam, Netherlands

JCAP04(20

Data management: open access and where possible open data

People: Suzan Basegmez du Pree: dark matter in KM3NeT
Daan van Eijk: KM3NeT construction, neutrino oscillations

Luca Visinelli: axion dark matter, sterile neutrinos
Bouke Jung: KM3NeT event reconstruction, neutrino oscillations

Further funding: keep your eyes open!

Collaboration: neutrino/dark matter forum

HIdden Universe Kickoff Meeting

Wednesday, 30 October 2019 from 09:00 to 14:00 (Europe/Amsterdam)
at Nikhef (H220)

Manage

Description Kickoff meeting for the NWO Physics Vrij Programma Hidden Universe

Wednesday, 30 October 2019

09:30 - 09:40	Welcome and Introduction *10'* Speaker: Paul de Jong
09:40 - 10:10	KM3NeT plans *30'* Speaker: Paul de Jong
10:10 - 10:40	XENON plans *30'* Speakers: Patrick Decowski, Auke-Pieter Colijn
10:40 - 11:00	Coffee Break
11:00 - 11:30	Dark Matter analysis *30'* Speakers: Suzan Basegmez du Pree, Dr. Suzan du Pree (Nikhef)
11:30 - 12:00	Future perspective on axion dark matter *30'* Speaker: Luca Visinelli (Universiteit van Amsterdam)
12:00 - 12:30	DM fit and interpretation *30'* Speaker: Sascha Caron
12:30 - 13:00	SHiP plans (t.b.c.) *30'*
13:00 - 14:00	Lunch