

Introduction (Paul de Jong)

Oscillation physics with KM3NeT/ORCA (Valentin Pestel)

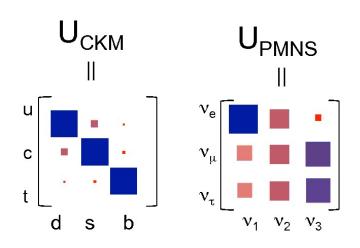


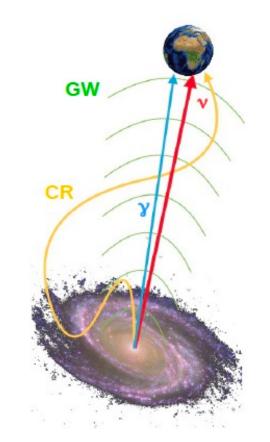
Cosmic neutrinos with KM3NeT/ARCA (Rasa Muller)



## **Neutrino Group Physics Ambitions:**

- Neutrino properties through oscillations
   Neutrino mass ordering: normal or inverted?
   Mixing parameters, test of 3-generation framework
   CP-violation in neutrinos
- Astrophysics: neutrinos as messengers
   Find sources and study physics inside sources
   Multi-messenger: relation gravitational waves, CR, γ-rays
- Dark matter
   Neutrinos from DM annihilation, sterile neutrinos
- Fundamental physics, BSM physics





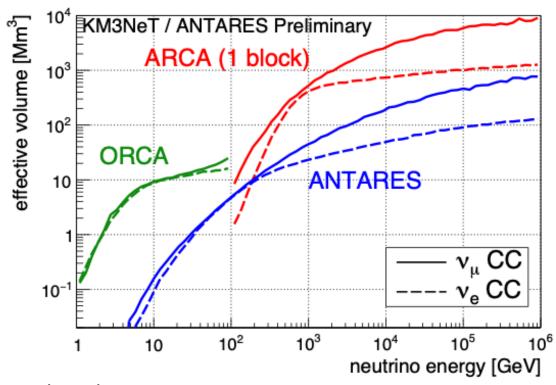
### **Glossary:**

**KM3NeT:** a km³ neutrino telescope in the Mediterranean Sea.

One densely instrumented block **ORCA** (France): neutrino oscillation physics

Two large blocks <u>ARCA</u> (Italy): astrophysics with cosmic neutrinos

**ANTARES**: a predecessor, since 2007, near Toulon



**DUNE**: Deep Underground Neutrino Experiment

at Sanford Underground Research Facility, Lead, South Dakota, USA

4 x 10kton Liquid Argon TPC, neutrino oscillation physics

Neutrino/antineutrino beam from Fermilab (baseline 1300 km)

A prototype single-phase LAr TPC ProtoDUNE built at CERN (beam data 2018, cosmics 2019)

ProtoDUNE II to be operational in 2022

# **The Nikhef Neutrino Group**





Joined: Staff: Mieke Bouwhuis (moved from CT)

Postdoc: Alba Domi, Jhilik Majumdar

PhD: Clara Gatius, Vikas Gupta

MSc: Niels Runge, Cecile van der Stappen, Alejandro Sanchez

BSc students: Annet Konings, Douwe Remmelts, Maria Hernandez, Kaitlin Dumoulin, Duña van der Horst, Ulusal Issever, Nina van der Meulen

Exchange student: Victor Carretero Stagiair: Hatim Hashi

**<u>Left</u>**: Postdoc: Rodrigo Gracia, Alfonso Garcia, Fatih Bay

PhD: Karel Melis, Milo Vermeulen, (Lodewijk Nauta defends June 8th)

Funding: NWO Physics Programme "The Hidden Universe of Weakly Interacting Particles" VICI Aart Heijboer

NWO Roadmap Grootschalige Wetenschappelijke Infrastructuur

ESCAPE, InfraDev2 (2022)

### **Antares**

On February 12th, 2022, Antares data taking was permanently stopped after ~15 years Disconnecting and dismantling has started.

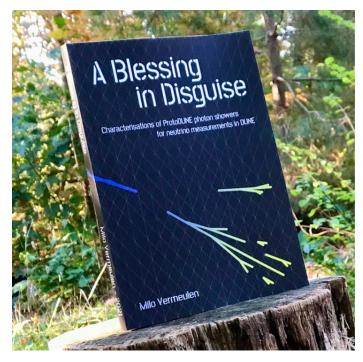




Data analysis still in progress: source searches, correlations with blazars and radio galaxies.

## **DUNE**

Milo Vermeulen first Nikhef DUNE PhD thesis:



ProtoDUNE data acquisition and compression Photon shower reconstruction Electron- $\pi^0$  separation Energy calibration

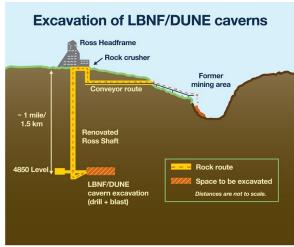
New PhD student: Vikas Gupta

Technical Design Report for Far Detector Conceptual design for Near Detector Accelerator construction at FNAL started



Excavation at SURF has started
Ultimate goal: 4 x 10 kton Lar TPC
staging: start with 2 modules
horizontal drift/vertical drift
ProtoDUNE II at CERN in 2022

@Nikhef: VUV setup (Tina)  $\pi^0$  reconstruction (Vikas)



## KM3NeT

Construction at Nikhef: nice facilities in PiMu hall, good progress. @Nikhef: DOMs for ~20 DUs produced

Bottlenecks: retirements de Boer, Fransen, Kayzel global supply crisis, esp. electronic components deployment at sea: boat + weather + permits

#### **ORCA status**

6 DUs operational February 2020-November 2021 (ORCA6)
November 2021: 4 more DUs
However: corrosion on hydrophone connectors on latest DUs
Currently operating with 7 DUs, more ready to be deployed soon.

#### **ARCA** status

6 DUs operational since April 2021 (ARCA6) More deployed in September 2021 (ARCA7/8/9) Deployment of up to 12 more DUs planned in June





## KM3NeT

## Big thank you to construction crew:

Construction a @Nikhef: DON

Bottlenecks: re

#### **ORCA status**

6 DUs operat Currently op

#### **ARCA** status

<sup>6 DUs operat</sup> + test shifters More deploy

Edward Berbee, Hans Band, Antonio D'Amico, Jan Willem Schmelling, Paul Timmer, de Peter Jansweijer, Vincent van Beveren, Jean Paul Fransen, Frank Kayzel, René de Boer, Oscar van Petten, Robin Schmeitz, November 2 Willem Scholte, Jorgen Brinkman, Gino Hoft, However: co Ivan Gromov, Mohammed van de Kraats, Ronald Bruijn, Daan van Eijk, Ernst-Jan Buis, Valentin Pestel, Thijs van Eeden

Deployment of up to 12 more DUs planned in June