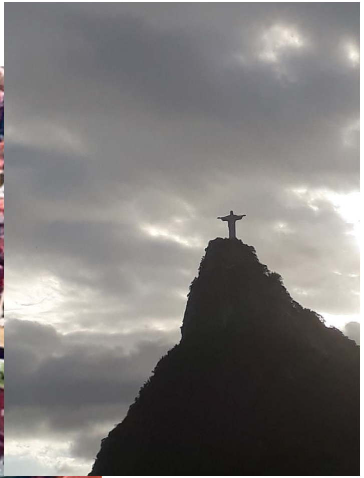
Brasil

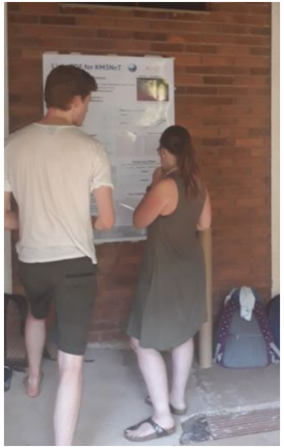


Brasil

~ 35 Brazilians
~ 60 internationals

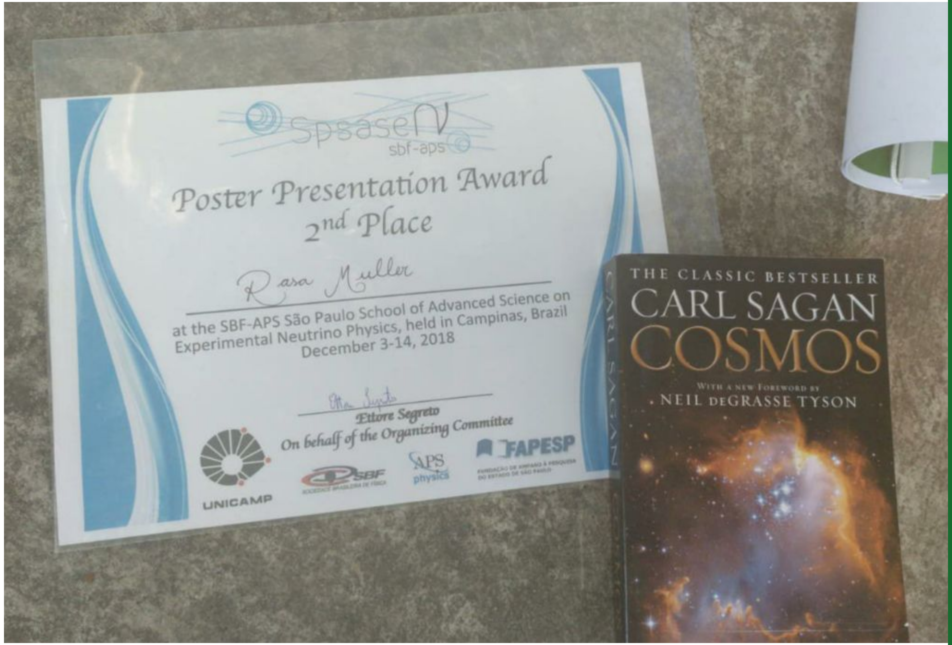
Many speakers & topics →

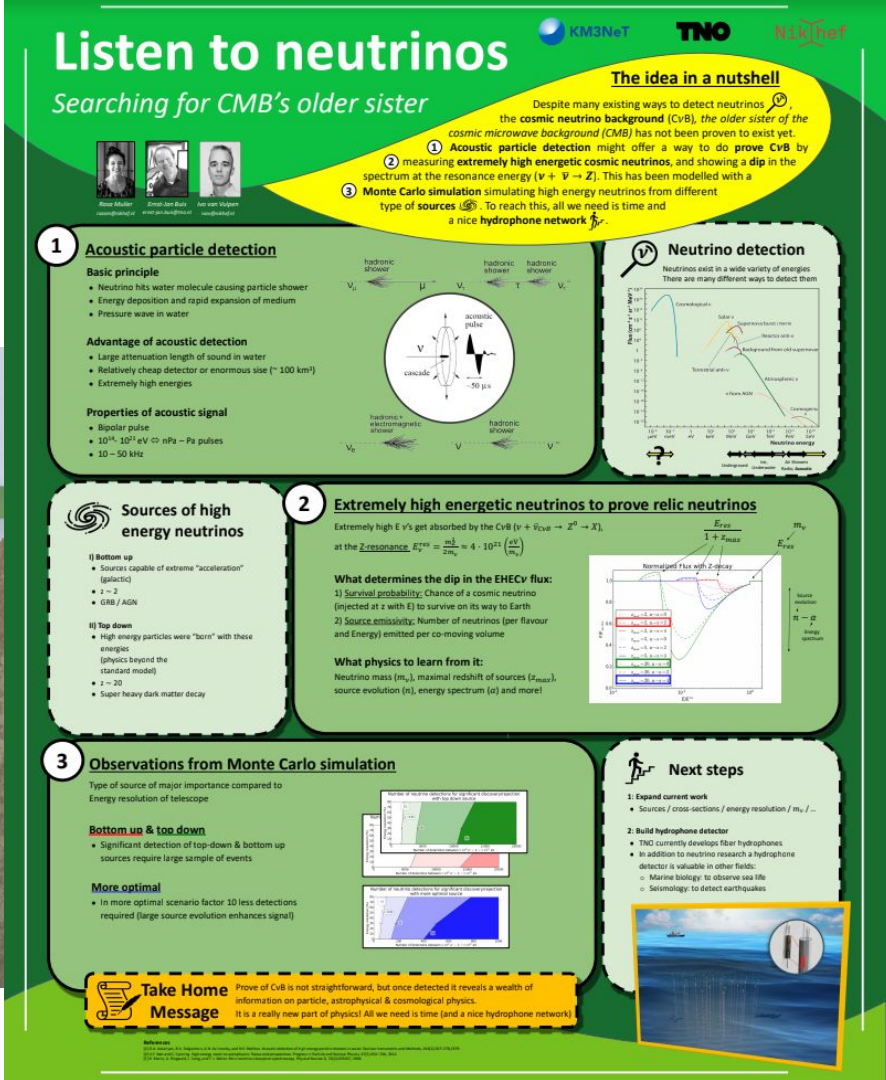
Poster sessions


- Ed Blucher, University of Chicago USA: *DUNE Experiment*
- Francesco Vissani, INFN – LNGS Italy: *Neutrino Theory*
- Flavio Cavanna, FERMILAB, USA: *Microphysics of fundamental processes in LAr/LArTPC*
- Ornella Palamara, FERMILAB, USA:: *Short-baseline neutrino experiments*
- Michelle Stancari, FERMILAB,USA: *Experimental techniques for neutrino detection*
- Kate Scholberg, Duke University, USA: *Supernova neutrino physics*
- Luciano Pandola, LNS-INFN, Italy: *Measurements on Neutrino Masses*
- Ines Gil Botella CIEMAT Spain: *LAr Double-Phase Detectors*
- Mary Bishai, BNL, USA: *Physics with high intensity beams*
- Roberto Acciarri FERMILAB USA: *protoDUNE*
- Jonathan Asaadi, UTA, USA: *LArIAT and Lar Cross Sections*
- Justin Evans, Manchester, UK: *Super-Nemo experiment*
- Diego Gamez-Garcia, Manchester, UK: Aspects of scintillation light simulations in LArTPCs
- Ana Amelia B. Machado, UFABC, Brazil: *ARAPUCA in proto DUNE, SBND and DUNE*
- Ettore Segreto, UNICAMP, Brazil: *Inovative Light Detection Techniques in LAr*
- Célio A. Moura, UFABC, Brazil: *Beyond Standard Model Physics in Long-baseline experiments*
- Franciole Marinho, UFSCAR, Brazil: *Monte Carlo techniques for detector R&D*
- Carla Bonifazi, UFRJ, Brazil: *Connie Experiment*
- Douglas Galante, LNLS, Brazil: *The LNLS and SIRIUS*
- Renata Zukanovich Funchal, USP, Brazil: *Theoretical Brazilian neutrino physics: theory roadmap*
- Marcelo Moraes Guzzo, UNICAMP, Brazil: *Partículas Fantasmagóricas* (outreach)
- Zelimir Djurcic, Argonne National Laboratory, USA: *Reactor Neutrinos*
- Diego Gratieri, UFF, Brazil: *Proton decay in DUNE*
- Vinicius Pimentel, CTI, Brazil: *Low signal and general measurements applied to scientific instrumentation*

Brasil


Poster Presentation Award
2nd Place
Rasa Muller
at the SBF-APS São Paulo School of Advanced Science on Experimental Neutrino Physics, held in Campinas, Brazil
December 3-14, 2018
Ettore Segreto
On behalf of the Organizing Committee
UNICAMP
SBF
APS physics
FAPESP
THE CLASSIC BESTSELLER
CARL SAGAN
COSMOS
WITH A NEW FOREWORD BY
NEIL DEGRASSE TYSON


KM3NeT
TNO
Nikhef
Listen to neutrinos
Searching for CMB's older sister
The idea in a nutshell
Despite many existing ways to detect neutrinos, the cosmic neutrino background (CνB), the older sister of the cosmic microwave background (CMB) has not been proven to exist yet.
1 Acoustic particle detection might offer a way to do prove CνB by
2 measuring extremely high energetic cosmic neutrinos, and showing a dip in the spectrum at the resonance energy ($\nu + \bar{\nu} \to Z$). This has been modelled with a
3 Monte Carlo simulation simulating high energy neutrinos from different type of sources. To reach this, all we need is time and a nice hydrophone network.
1 Acoustic particle detection
Basic principle
Neutrino hits water molecule causing particle shower
Energy deposition and rapid expansion of medium
Pressure wave in water
Advantage of acoustic detection
Large attenuation length of sound in water
Relatively cheap detector or enormous size (~ 100 km³)
Extremely high energies
Properties of acoustic signal
Bipolar pulse
10 – 50 kHz
acoustic pulse
cascade
Neutrino detection
Neutrinos exist in a wide variety of energies
There are many different ways to detect them
Sources of high energy neutrinos
I) Bottom up
Sources capable of extreme "acceleration" (galactic)
GRB / AGN
II) Top down
High energy particles were "born" with these energies (physics beyond the standard model)
Super heavy dark matter decay
2 Extremely high energetic neutrinos to prove relic neutrinos
What determines the dip in the EHECν flux:
1) Survival probability: Chance of a cosmic neutrino (injected at z with E) to survive on its way to Earth
2) Source emissivity: Number of neutrinos (per flavour and Energy) emitted per co-moving volume
What physics to learn from it:
Neutrino mass (m_ν), maximal redshift of sources (z_{max}), source evolution (n), energy spectrum (α) and more!
Normalized Flux with Z-decay
3 Observations from Monte Carlo simulation
Type of source of major importance compared to Energy resolution of telescope
Bottom up & top down
Significant detection of top-down & bottom up sources require large sample of events
More optimal
In more optimal scenario factor 10 less detections required (large source evolution enhances signal)
Next steps
1: Expand current work
2: Build hydrophone detector
TNO currently develops fiber hydrophones
In addition to neutrino research a hydrophone detector is valuable in other fields:
Marine biology: to observe sea life
Seismology: to detect earthquakes
Take Home Message
Prove of CνB is not straightforward, but once detected it reveals a wealth of information on particle, astrophysical & cosmological physics.
It is a really new part of physics! All we need is time (and a nice hydrophone network)

Outreach

Nederlandse Natuurkundige Vereniging

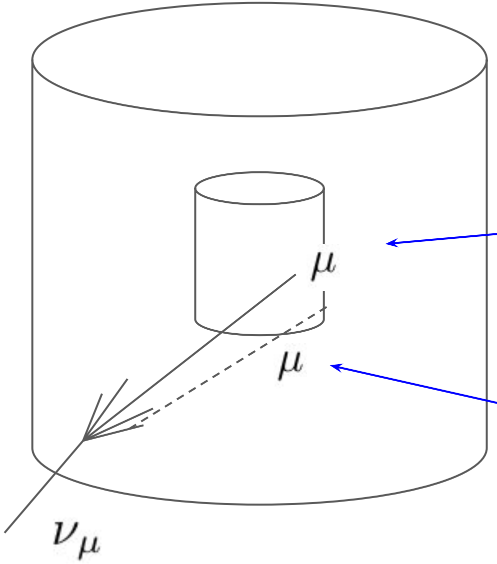
- Physics career booklet

https://www.nnv.nl/media/files/Loopbaanboekje2018-hires.pdf

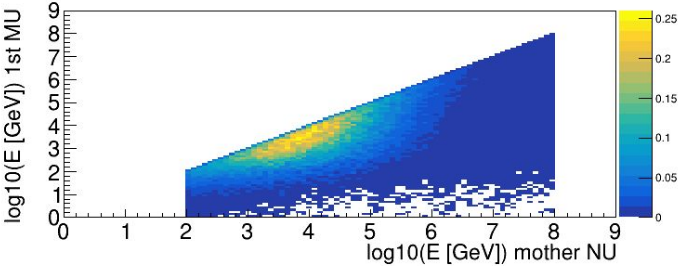
- Asked to become Editorial member of

NEDERLANDS TIJDSCHRIFT VOOR NATUURKUNDE

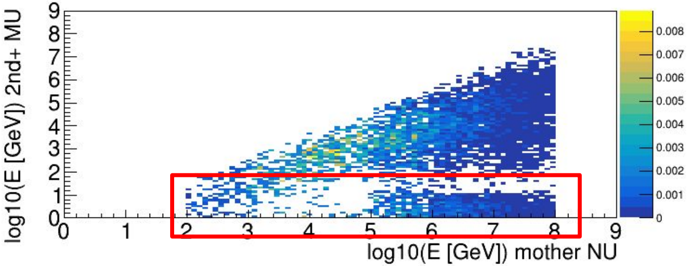
NUMUCC



Leading lepton muons



Hadronic shower muons



Analyse
2nd band structure

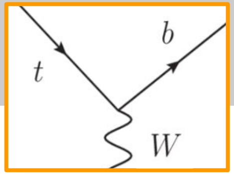
```
Monte Carlo Tracks for event 29239
 --> nu_mu (primary neutrino) E=8.55145e+07 status/id=0/0
      ^H`-mu- (leading_lepton) E=8.52327e+07 status/id=1001/4
          ^H`-mu- E=6.76511e+07 status/id=1/214
 --> unnamed state (1000130270) E=25.1265 status/id=0/1
     |^H+-proton E=0.929354 status/id=11/2
     |      ^H`-unnamed state (2000000001) E=281812 status/id=12/5
     |          |^H+-W+ E=72798.4 status/id=12/6
     |          |    |^H+-s_bar E=4936.36 status/id=12/10
     |          |          ^H`-CMshower E=72798.4 status/id=12/12
     |          |               |^H+-s_bar E=8122.14 status/id=12/13
     |          |               |     |^H+-s_bar E=2092.64 status/id=12/15
     |          |               |     |      ^H`-s_bar E=2092.64 status/id=12/37
     |          |               |     |           ^H`-string E=72798.4 status/id=12/61
     |          |               |     |                |^H+-Lambda0_bar E=617.797 status/id=12/62
     |          |               |     |                |     |^H+-antiproton E=484.467 status/id=1/103
     |          |               |     |                |      ^H`-pi+ E=133.33 status/id=1/104
```

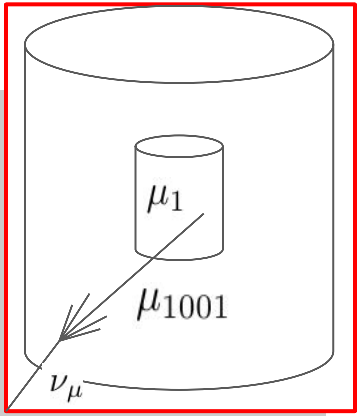
muon enters can (status 1001 → 1)

Hadronic System (nucleus)

probably top quark involved*

Hadronic Shower






```
     |          |^H+-b E=211162 status/id=12/7
     |          |    ^H`-string E=211167 status/id=12/50
     |          |         |^H+-B*0_bar E=151870 status/id=12/51
     |          |         |     |^H+-B0_bar E=150455 status/id=12/84
     |          |         |     |     |^H+-D*+ E=82877.6 status/id=12/131
     |          |         |     |     |     |^H+-D+ E=77309.3 status/id=12/162
```

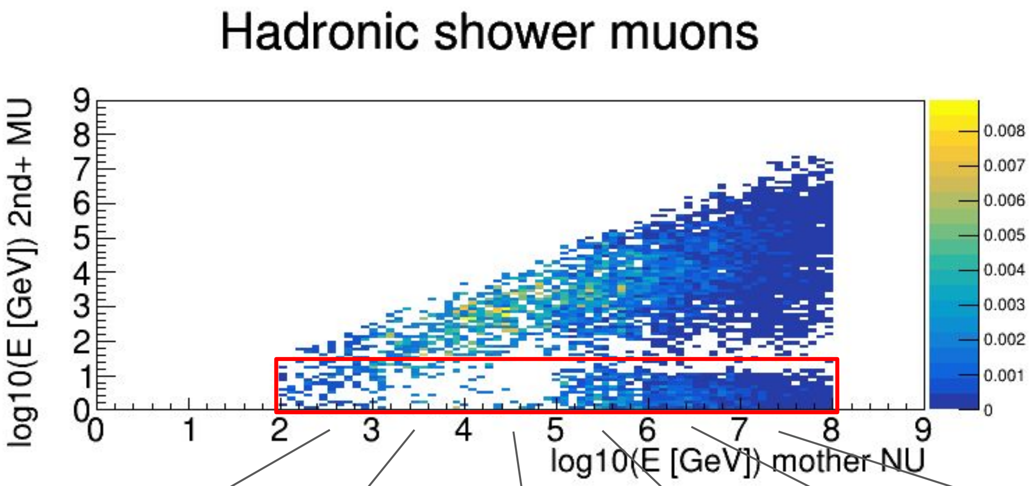
```
     |          |^H+-ud_0 E=5.08919 status/id=12/8
     |           ^H`-B*+ E=18.4853 status/id=12/9
     |               |^H+-B+ E=18.228 status/id=12/59
     |               |     |^H+-nu_mu E=2.39049 status/id=1/100
     |               |     |^H+-mu+ E=2.88347 status/id=1/101
     |               |      ^H`-D0_bar E=12.9555 status/id=12/102
     |               |           |^H+-K+ E=4.64409 status/id=1/144
     |               |           |^H+-pi- E=3.03789 status/id=1/145
     |               |           |^H+-pi0 E=1.16447 status/id=12/146
     |               |           |     |^H+-gamma E=1.09356 status/id=1/175
     |               |           |      ^H`-gamma E=0.0709045 status/id=1/176
     |               |            ^H`-pi0 E=4.1089 status/id=12/147
     |               |                 |^H+-gamma E=2.02707 status/id=1/177
     |               |                  ^H`-gamma E=2.08178 status/id=1/178
     |                ^H`-gamma E=0.257368 status/id=1/60
      ^H`-unnamed state (1000120260) E=24.1971 status/id=1/3
```

Muon in hadronic shower!

Hypothesis: top quark production

* cannot be handled well by PYTHIA cause only hypothetical meson with top quark

How often a W-boson in low E evt?



	2-3	3-4	4-5	5-6	6-7	7-8
NOT weighted	0 %	0 %	3.4 %	77.2 %	83.2 %	84.9 %
Weighted	0 %	0 %	2.2 %	76.6 %	82.8 %	85.6 %

1

```
evt.w[1] * TMath.Power(Nu.E, -2) * 1e-4 / Ngen
```