

News from the projects

RNO-G (submitted by Anna Nelles)

RNO-G met for the annual collaboration meeting in Brussels hosted by Simona Toscano, who is also the newly elected chair of the executive board. She replaces Nick van Eijndhoven who will retire before the end of this year. Nick has paved the way for RNO-G with securing significant funds from the FWO, but most importantly his eternal optimism that things will work, if one just continues to try. The collaboration dinner was held in Nick's honor, given that his speeches always were a highlight every year, celebrating accomplishments and making grand plans. The new RNO-G leadership is completed with Steph Wissel as US PI and Anna Nelles as EU PI. During the meeting many students presented their ongoing work and upcoming paper drafts, making the discussions lively and forward-looking. As RNO-G is entering its 6th year since inception, a large cohort of PhD students has graduated this year, marking the path of RNO-G from early commissioning data into more mature data taking.

While writing this report, the RNO-G stations are enjoying their last days of data taking with the Sun rising shorter and shorter above the horizon in Greenland. A new set of wind-turbines sporting new cold temperature lubricants and different geometries will ideally extend life-time during the dark months. A new industrial device will monitor ice formation and icing conditions, hopefully helping in understanding how wind-turbines can be made more reliable for in-winter operation.



The RNO-G collaboration at the Brussels meeting

KM3NeT: Welcome ARCA 62!

Between September 4 and September 20, a sea campaign was conducted at the KM3NeT ARCA site. The campaign led to a significant step forward in the construction of the apparatus, including an enlargement of the submarine infrastructure and the detector and an upgrade of its acoustic positioning system.

The operation was carried out in two hitches, sailing from Malta. The ship was the *levoli Amber*, equipped with a work-class deep-sea Remotely Operated Vehicle. It is operated by NGS (Next Geo Solutions) and was at its first service for KM3NeT.

The operation started with the deployment of two submarine junction boxes and four interlink cables, two for each junction box, and their connection to the sea-floor network, in preparation for the further

expansion of the infrastructure. **A dozen detection units were installed**, one of them replacing a non-functional detection unit installed earlier. For each of them this operation implied: deployment with a precise positioning on the sea bottom, connection to the junction box and unfurling, with detailed inspections and functional tests carried out before and after unfurling. All Digital Optical Modules were found operational after installation. An inspection of the submarine infrastructure and an upgrade of the acoustic positioning system with the installation of two additional emitters and precise measurements of their positions were also performed.

The weather was far from ideal for part of the time, requiring several rearrangements of the planning throughout the operation. Overall, this operation has set a new record of efficiency for KM3NeT, leading to an ARCA detector which now includes 62 detection units, connected to shore through a network comprising two long-distance electro-optical cables and seven submarine junction boxes. A further sea operation is planned for the end of September, in order to deploy Cable Termination Frame 3 (CTF3), which will service the second building block of ARCA.



From top to bottom: offshore team; onshore team for the first hitch and onshore team for the second hitch.



The deck of Ievoli Amber loaded with detection units awaiting deployment at the ARCA site.

IceCube

IceCube 15-year Symposium in Chiba: On September 10, we celebrated 15 years of IceCube with a symposium in Chiba, Japan. While we spent some time reflecting on the research accomplishments, we were also eagerly looking forward to new data from the Upgrade and the potential of Gen2. The program from the symposium can be found here:

<https://indico-icehap.phys.s.chiba-u.ac.jp/event/10/>

IceCube at TeVPA: Many IceCubers converged in Tendo, a beautiful onsen town in Japan for the TeV Particle Astrophysics 2026 conference (<https://indico-icehap.phys.s.chiba-u.ac.jp/event/3/>). There were over 25 presentations on IceCube and we

enjoyed some social time together at an IceCube BBQ party (see photo). We are already looking forward to TeVPA 2027, which will be in Madison, USA.



(submitted by Erin Sullivan)

Sunrise at the South Pole: Winterover Alicia Fattorini sends another bunch of pictures, here are two of them, taken shortly before sunrise.



The South Pole Telescope (SPT) on the left and the BICEP telescopes in the center and on the right, just before sunrise. Both devices explore the 2.7 K radiation.



Decorations in the galley for the sunrise dinner. The flags displayed on the windows come from the ceremonial Pole and have been weathered by the strong winds and the harsh winter season.

Publications

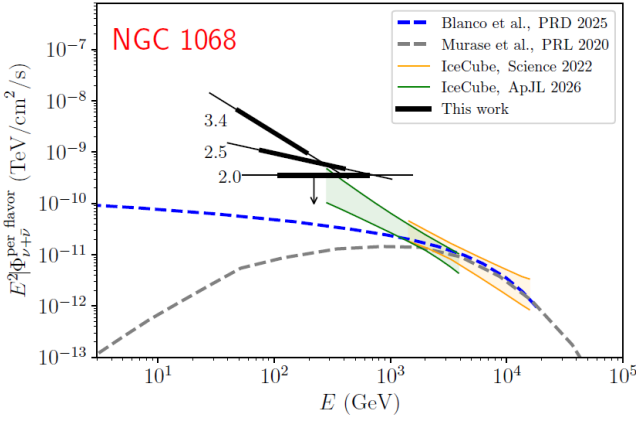
The IceCube Collaboration has posted four new papers on arXiv:

Time-Integrated Searches for Sub-TeV Neutrino Sources with IceCube-DeepCore (submitted to ApJL, posted at <https://arxiv.org/pdf/2609.10931>). The main authors are Andrew Wang (Georgia Tech. Univ.)

ABSTRACT

We have developed techniques for a competitive sub-TeV time-integrated neutrino search and applied it to 11.1 years of IceCube-DeepCore data. The DeepCore subarray lowers the sensitivity of IceCube down to sub-TeV energies and is especially interesting for objects with soft spectra. Three studies were performed: a search for neutrino emission from AGN exhibiting high intrinsic X-ray flux, including NGC 1068, as identified by SWIFT/BAT; a search for neutrino emission from Galactic objects identified by Fermi-LAT as exhibiting a spectral shape consistent with neutral pion decay; and an all-sky search for neutrino point sources. Objects for this study were selected given their prospects for sub-TeV neutrino emission. No evidence for sub-TeV neutrino emission is found in any of the searches performed. Finally, for each catalog of objects, we use a statistical combination of the p-values via a binomial test to search for aggregated neutrino emission from a subset of the objects. Neither of the binomial tests yields significant results. For NGC 1068, assuming a power law spectrum with index 3.4, the 90% confidence level upper limit on per-flavor neutrino emission in the 30–400 GeV range is $F_{\nu+\text{anti-}\nu} | 1\text{TeV} < 9.5 \times 10^{-11} \text{ TeV}^{-1} \text{ cm}^{-2} \text{ s}^{-1}$, a factor of two higher than the extrapolation of IceCube’s measurement at higher energies. We additionally provide neutrino flux upper limits for a variety of spectra.

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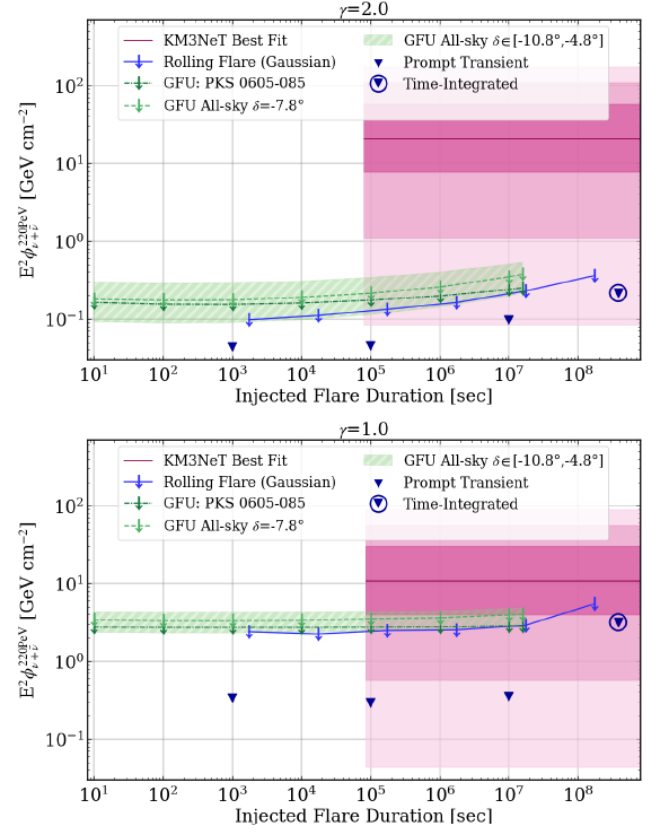
Per-flavor $\nu + \bar{\nu}$ upper limits for NGC 1068 as a function of energy for three spectral indices (solid black). The thick black lines correspond to the central 68% energy range, while the thin black lines denote the central 95% energy range.

IceCube neutrino point-source searches in the direction of the KM3NeT ultra-high-energy event

(submitted to PRL, posted at <https://arxiv.org/pdf/2609.12055>). The leading authors are Sarah Mancina (Univ. Padova), Alicia Mand (UW Madison) and Riya Shah (Drexel Univ.).

ABSTRACT:

While still under construction, the KM3NeT-ARCA detector recorded a ~ 200 PeV neutrino on February 13th, 2023. This event is the highest energy neutrino reported. IceCube, a cubic kilometer neutrino detector located at the geographic South Pole, has previously detected neutrinos up to approximately 10 PeV. We search for high energy neutrinos from the location of the KM3NeT event using 15 years of IceCube data and considering three temporal hypotheses: steady or flaring in time coincidence, or at an arbitrary time. We find no evidence for neutrino emission for any of the studies performed. Correspondingly, we set upper limits on the neutrino flux from a point source in the direction of KM3-230213A. We compare these limits to KM3NeT's estimated flux and show that an astrophysical explanation of this event is strongly constrained for a variety of spectral assumptions for a steady or transient point source with the flux inferred from the single KM3NeT ultra-high-energy event assuming a spectral index of 2.0.

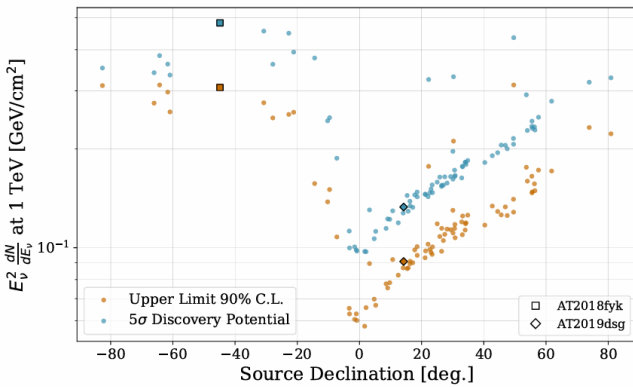


The 90% C.L. upper limits on the time integrated $\nu + \bar{\nu}$ per-flavor flux at 220 PeV from IceCube in the direction of KM3-230213A as a function of the flare duration assuming an unbroken power-law with $\gamma = 2$ (top) and $\gamma = 1$ (bottom). The blue triangles are for the prompt transient analyses that searched time windows centered on the detection time of KM3-230213A and the time-integrated analysis (circled). The solid, blue line is for the rolling flare analysis which looked for best-fit flares across the entire dataset (note: here the time-profile of the flare is treated as a Gaussian instead of a uniform boxed time-window). The dashed, light-green line is for the all-sky GFU-cluster alerts both online and in the archival data for a source at $\delta = -7.8^\circ$, and the shaded area represents the region between -4.8° (lower edge) and -10.8° (upper edge). The dashed-dotted, dark-green line is for PKS 0605-085 from the GFU-cluster source-list alerts. The KM3NeT best-fit flux is indicated by the dark pink line and shaded pink regions indicating the 1σ , 2σ , and 3σ bands of the KM3NeT measurement and are calculated using values from S. Aiello et al. (KM3NeT), Nature 638, 376 (2025), and multiplying by the livetime of ARCA. For bottom panel, the KM3NeT flux has been recalculated to adopt a flux and error region for $\gamma = 1$. Because KM3NeT's effective area and correspondingly, its acceptance, is time-dependent due to its location, we have limited the shaded region to be for times flare durations greater than 1 day. All limits were obtained adopting the same deep inelastic scattering cross section as KM3NeT.

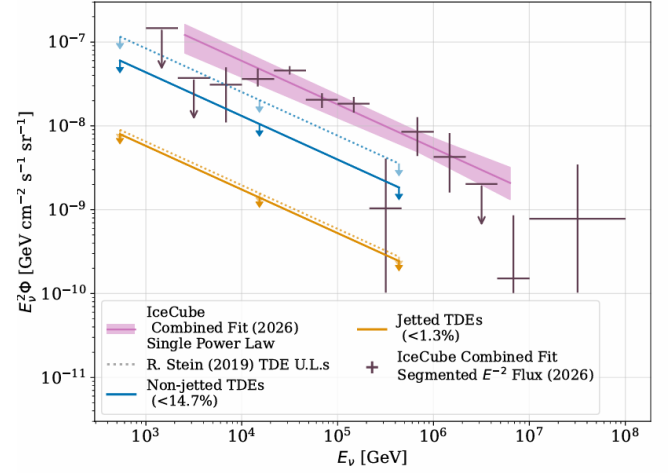
Search for Neutrinos from Tidal Disruption Events with IceCube (submitted to ApJL, posted at <https://arxiv.org/pdf/2609.00657>. Main author is Shannon Gray (Univ. Maryland)

ABSTRACT

Tidal disruption events (TDEs) are theorized to produce high-energy neutrinos through photo hadronic interactions between accelerated protons and multi-wavelength photons in the accretion disk and outflows. Detecting these neutrinos would provide insight into the dynamics of TDEs. Taking advantage of the recent increase in observed TDEs from wide field-of-view telescopes, we conduct a dedicated search for neutrinos coincident in optical/UV and X-ray wavelengths. We searched for neutrino emission from 89 TDEs selected based on X-ray and optical/UV observations using time dependent likelihood analysis methods in two parts. First, we searched for emission from individual sources, where we fit the time window of expected neutrino emission. Second, we performed a study of jetted and non-jetted TDE subpopulations using a stacking search with a fixed one-year time window. No significant neutrino excess was observed in either search. We set upper limits to the contribution of jetted and non-jetted TDEs detected in optical/UV and X-ray wavelengths to the diffuse astrophysical neutrino flux assuming TDEs are standard candles.



90% C.L. upper limits and median 5σ discovery potential of the time-integrated flux per TDE, assuming an $E^{-2} \nu$ spectrum, an expected ν emission window of 150 days and searching a maximum time window length of 1 year. $E^2 dN/dE_\nu$ is the per-flavor time-integrated flux, with number of neutrinos (N) and neutrino energy (E_ν), assuming a flavor ratio of 1:1:1. The locations of AT2019dsg and AT2018fyk are marked with a black square and black diamond outline, respectively, for reference.



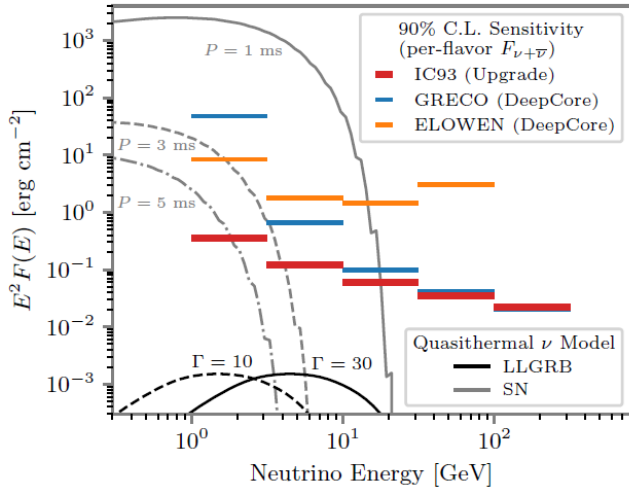
Limits on the per-flavor integrated $\nu + \bar{\nu}$ contribution of jetted and non-jetted TDEs to the diffuse neutrino flux as a function of neutrino energy. The dashed lines show the comparison to previous analyses, recalculated to compare to the same diffuse flux, with that for jetted TDEs in orange and non-jetted TDEs in blue.

Astrophysical Sensitivity Projections for the IceCube Upgrade (submitted to Phys.Rev. D, posted at <https://arxiv.org/pdf/2608.28395>). Main authors are Markus Dittmer (Univ. Münster), Yukiho Kobayashi (Chiba Univ.) and Berit Schlüter (Univ. Münster).

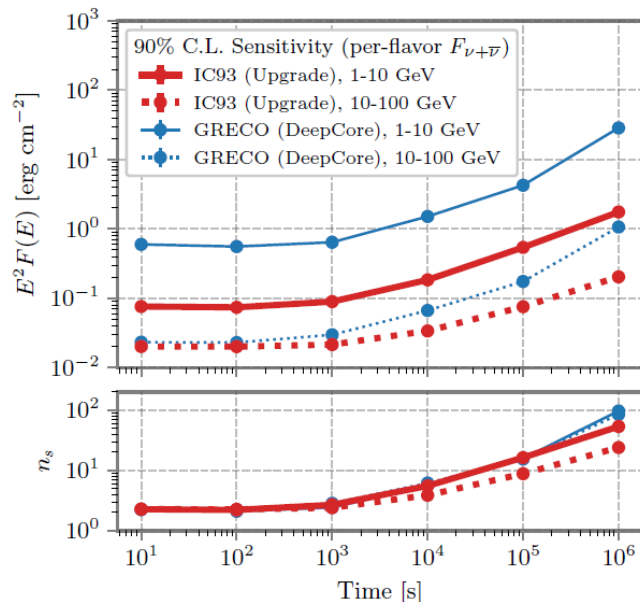
ABSTRACT

... The IceCube extension installed in 2025/2026 introduces densely instrumented multi-PMT optical modules within the existing infill array known as IceCube DeepCore. It is expected to enhance sensitivity in the GeV regime, with commissioning of the detector expected to be complete by the end of 2026. We present the projected sensitivities of the IceCube Upgrade for three key analyses: neutrino transient searches, steady emission from point sources such as NGC 1068, and diffuse emission from the MilkyWay. These case studies represent direct extensions of current IceCube analyses. Using new Monte Carlo datasets, we demonstrate that the IceCube Upgrade achieves order-of-magnitude improvement in sensitivity at low energies ($\lesssim 10$ GeV) for time-dependent sources across short timescales. Conversely, for time-independent searches, the relative impact of the Ice-Cube Upgrade's low-energy data is diluted by the decade-long accumulation of high-energy archival data. Nevertheless, we project significant improvements for soft-spectrum sources especially across the southern sky, driven by the

IceCube Upgrade's superior background rejection capabilities. The improved sensitivity at low energies for both transient and steady sources will open up an expanded discovery window for IceCube in the GeV band over the next decade.



Sky-averaged per-flavor differential sensitivity of the IC93 sample and the existing DeepCore datasets. The signal is injected following a power-law spectrum with an index of $\gamma = 2.0$. The observation time window is set to $\Delta T = 1000$ s. The black curves show the LLGRB quasi-thermal models with bulk Lorentz factor Γ and a distance of 10 Mpc. The gray curves indicate the SNe quasi-thermal models with the PNS rotational period P , magnetic field $B = 10^{15}$ G and a distance of 10 kpc.



Sky-averaged per-flavor sensitivity of the IC93 sample and GRECO dataset as a function of the observation time window. The sensitivity is evaluated in two energy bins, 1–10 GeV (solid lines) and 10–100 GeV (dotted lines), assuming a source spectral index of $\gamma = 2.0$.

And finally, an attempt on my part to provide an overview of the current experimental situation in our field:

Neutrino Astronomy at High Energies - An

Experimental Review, published in UNIVERSE 2026, 12/9, posted at <https://arxiv.org/pdf/2609.26436>.

ABSTRACT:

Neutrino astronomy at high energies is an emerging field but still in a state of infancy. It is barely a dozen years ago that a diffuse flux of extraterrestrial neutrinos with energies in the TeV and PeV ranges was detected and even fewer that first individual sources could be identified. A new window to the universe has been opened after four decades of efforts to realize the gigantic instruments that made that breakthrough possible. This review describes the road towards the present, reviews the actual status of the field and sketches future developments.

And at the very end, the most recent message from the South Pole: **The Sun is back!**



Impressum

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