ITeDA
Instituto de Tecnologías en Detección y Astropartículas

Poster rapporteur: Daniel Supanitsky

Arrival directions

1. **Amplifying UHECR arrival direction information using mass estimators at the Pierre Auger Observatory**

   Authors: L. Apollonio, for the Pierre Auger Collaboration

2. **Arrival directions of ultra-high-energy cosmic rays assuming heavy mass composition**

   Authors: A. Bakalová, J. Vícha, A. L. Müller

3. **Prospects for constraining transient sources of UHECRs with arrival-direction data**

   Authors: T. Bister and J. Biteau

4. **Anisotropies of ultra-high energy particles in cosmic magnetic fields**

   Authors: L. Deval, R. Engel, T. Fitoussi, E. Roulet, M. Unger

5. **On γ-rays as predictors of UHECR flux in AGNs**

   Authors: C. de Oliveiraa, P. Batistab, and R. Guedes Lang

6. **Correlation studies on UHECR source candidates with magnetic field model**

   Authors: R. Higuchi for the TA Collaboration

7. **Insights on super-heavy UHECRs scenario with large-scale structure simulation**

   Authors: R. Higuchi, E. Kido, and S. Nagatakiaboration

Arrival directions

8. **Signatures of ultra-high-energy cosmic ray sources in large-scale anisotropy measurements**

   Authors: L. A. Dourado, R. Guedes Lang , and V. de Souza

9. **Search for neutrons from Galactic sources with the Pierre Auger Observatory**

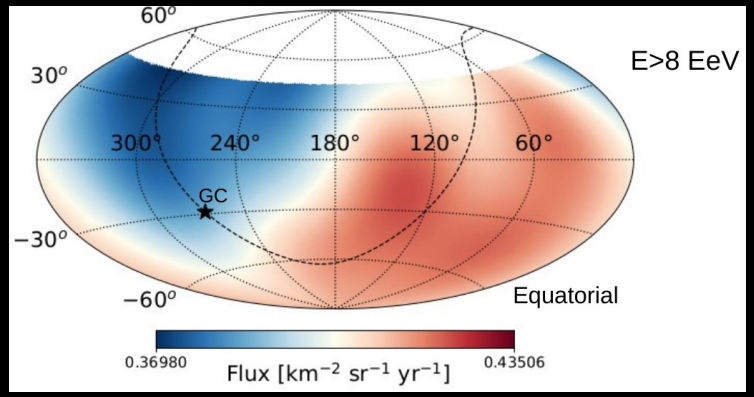
   Authors: M. A. Martins, for the Pierre Auger Collaboration

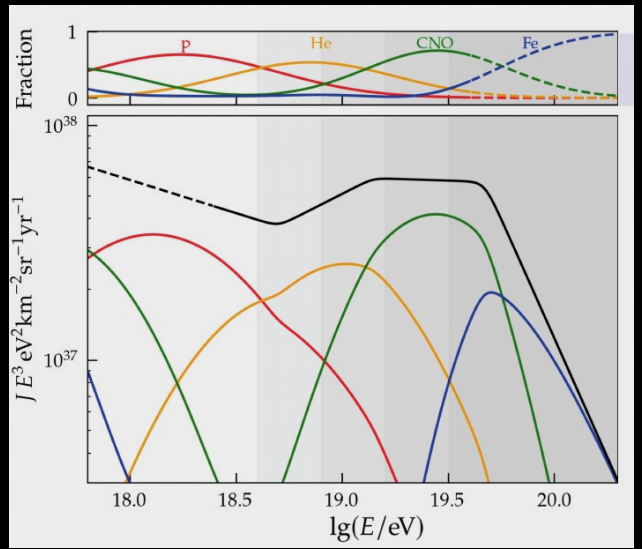
10. **Does the Local Bubble bias Galactic magnetic field reconstructions used to backtrack UHECRs?**

    Authors: V. Pelgrims, M. Unger, and I. C. Mariş

Prospects of a composition-enhanced search for large-scale anisotropy with the Pierre Auger Observatory

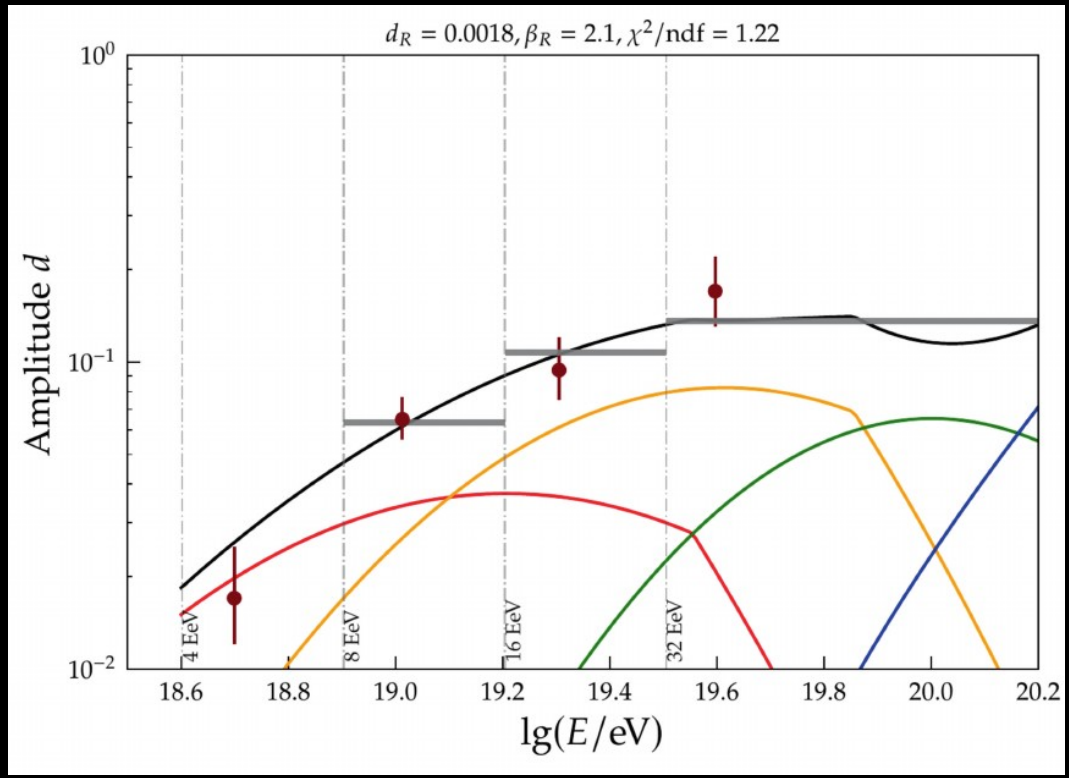
Authors: E. Martins for the Pierre Auger Collaboration





Composition model

$$d(E,Z) = d_R \left(\frac{E}{Z\, e\, \mathrm{EeV}}\right)^{\beta_R}$$

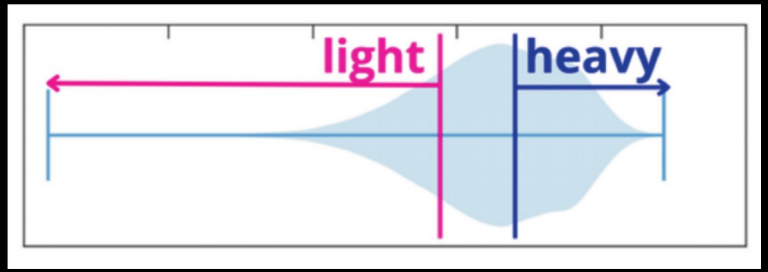


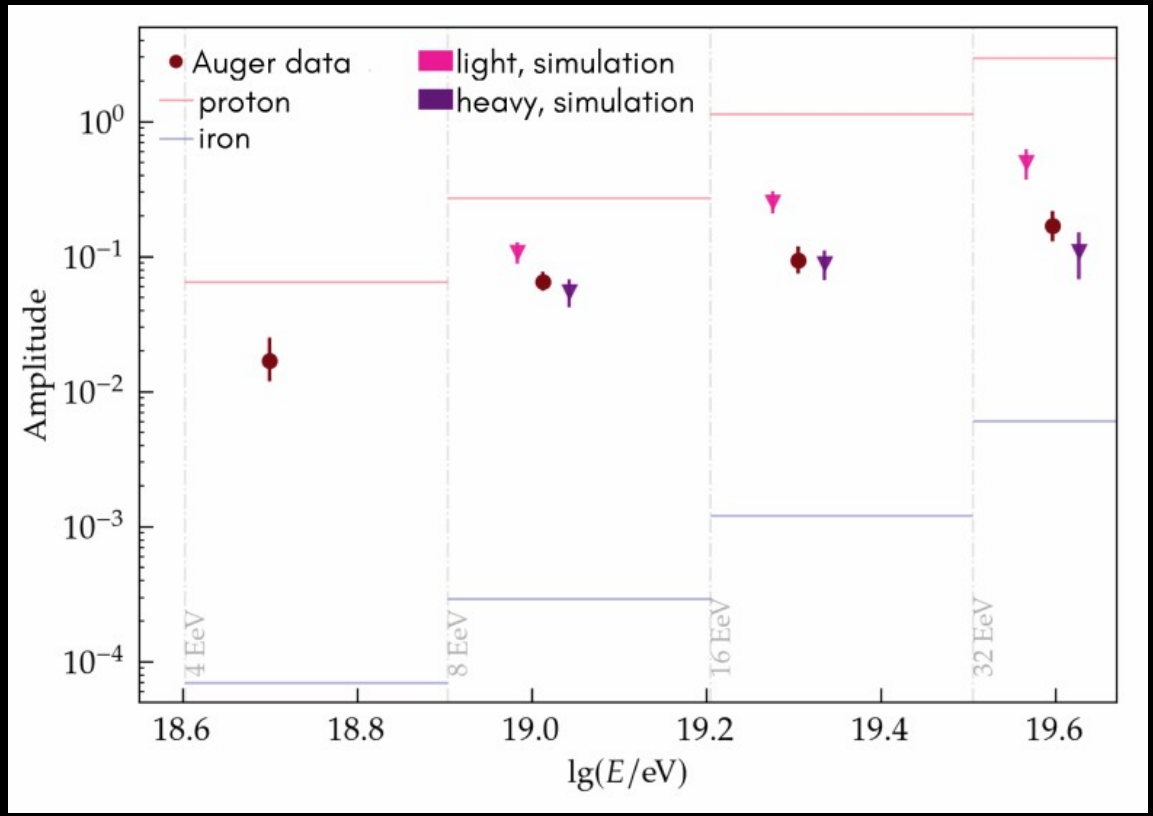
Prospects of a composition-enhanced search for large-scale anisotropy with the Pierre Auger Observatory

Authors: E. Martins for the Pierre Auger Collaboration

Simulations:

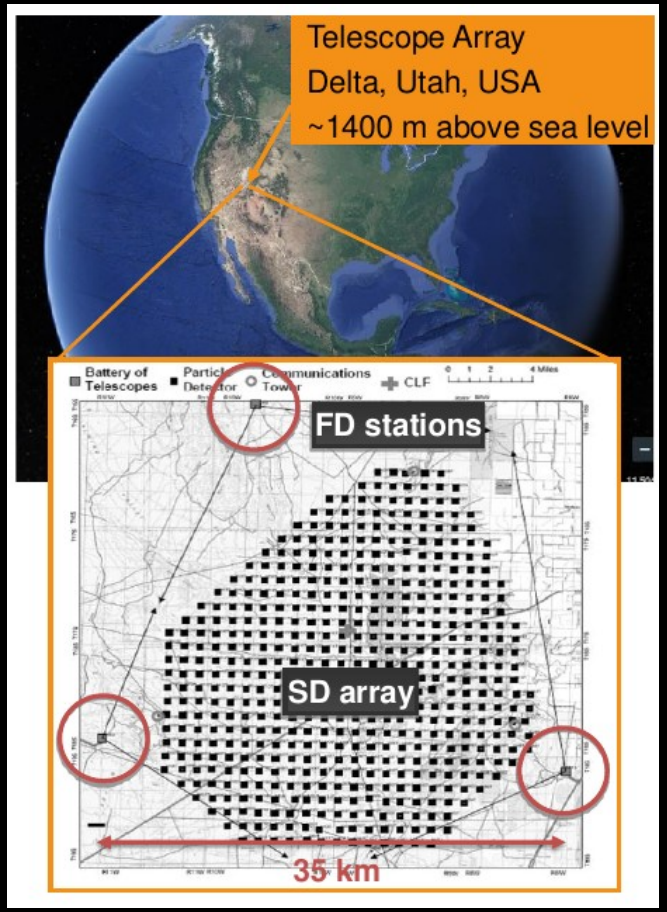
- Shower and detector response
- Reproducing the measured spectrum
- Composition compatible with X_{max} measurements
- Using $d(E, Z)$
- Mass estimator with Universality: $\ln A(X_{max}, R_{\mu})$

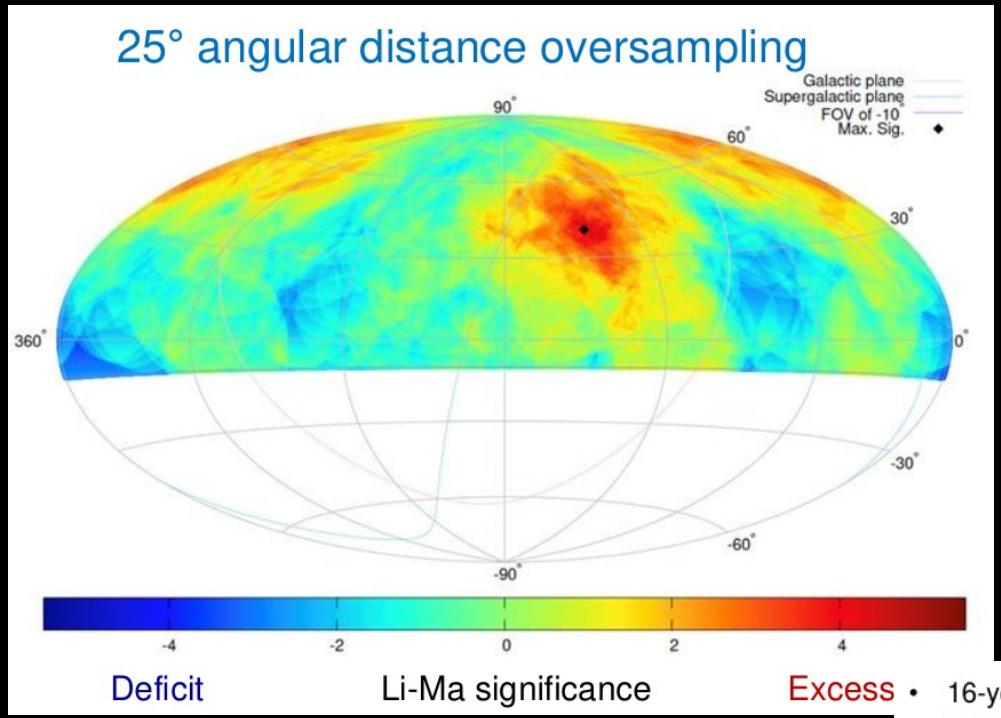




Telescope Array Surface Detector Medium-scale Anisotropy Analysis

Authors: J. Kim, D. Ivanov, K. Kawata, H. Sagawa, and G. Thomson, on behalf of the Telescope Array Collaboration





Telescope Array hot spot

$$E \geq 10^{19.76}\text{eV}$$

- 16-year TA SD data, $E > 5.7\times10^{19}$ eV
- 228 events (16-year TA SD data)
- Max local sig.: **4.9σ** at (144.0°, 40.5°)
  - N_{obs}: 46 events
  - N_{bg}: 19.1 events
  - ~141% excess
- Post-trial probability:
  $P(S_{MC} > 4.9\sigma) = 2.1 \times 10^{-3}$ → **2.9σ**

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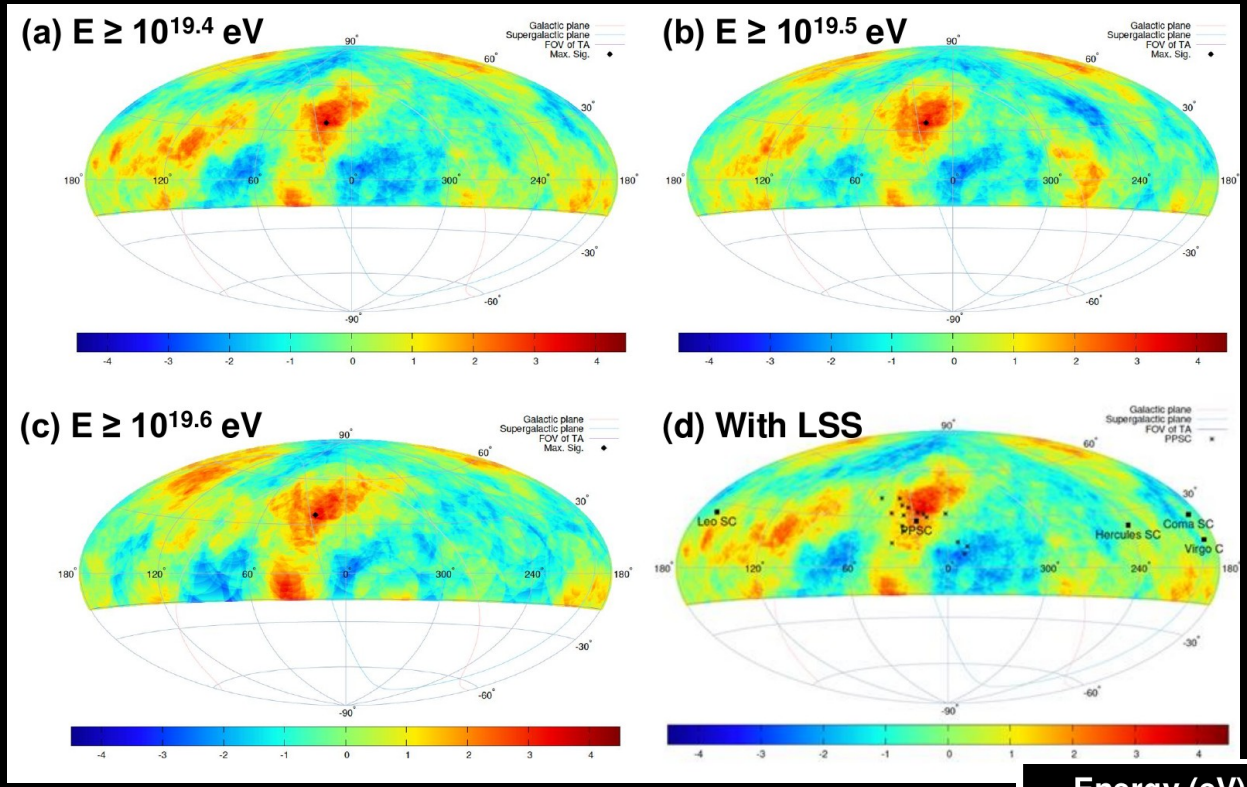
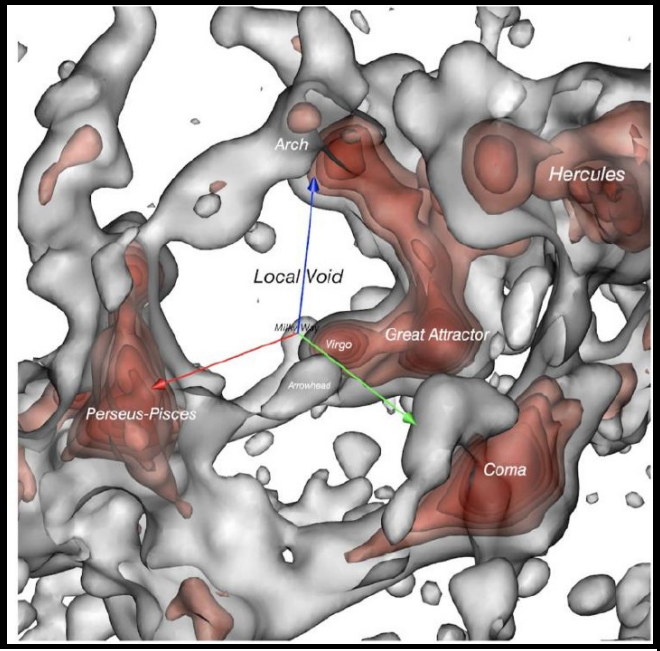


Li-Ma significances

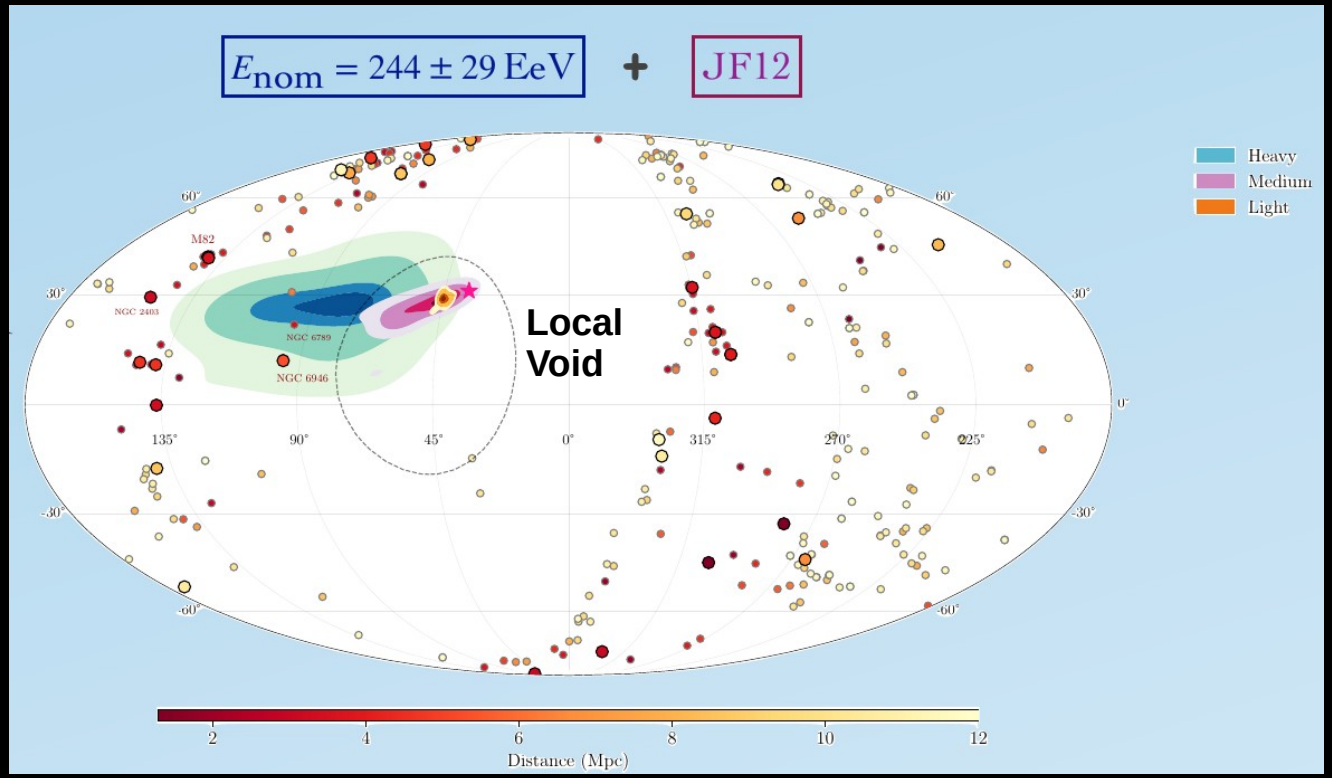
Perseus-Piesces supercluster excess



Energy (eV)	Events	Criteria	PPSC
$E \geq 10^{19.4}$	1186	($S_{mc} \geq 3.7\sigma$) & ($\theta_{mc} \leq 7.7°$)	**3.1σ**
$E \geq 10^{19.5}$	767	($S_{mc} \geq 3.9\sigma$) & ($\theta_{mc} \leq 7.4°$)	**3.2σ**
$E \geq 10^{19.6}$	464	($S_{mc} \geq 3.7\sigma$) & ($\theta_{mc} \leq 8.3°$)	**3.0σ**

Beyond the Local Void: A comprehensive view on the origins of the Amaterasu particle

Authors: N. Bourriche and F. Capel



The sources inject iron nuclei

Approximate Bayesian Computation, simulation based inference method, to estimate the **posterior distribution** of six free parameters: B_{rms}, L_c of the extra-Galactic magnetic and D_{src}, E_{src} and $(l, b)_{src}$

$$E = (244 \pm 29(\mathrm{stat.})^{+51}_{-76}(\mathrm{syst.}))\mathrm{EeV}$$

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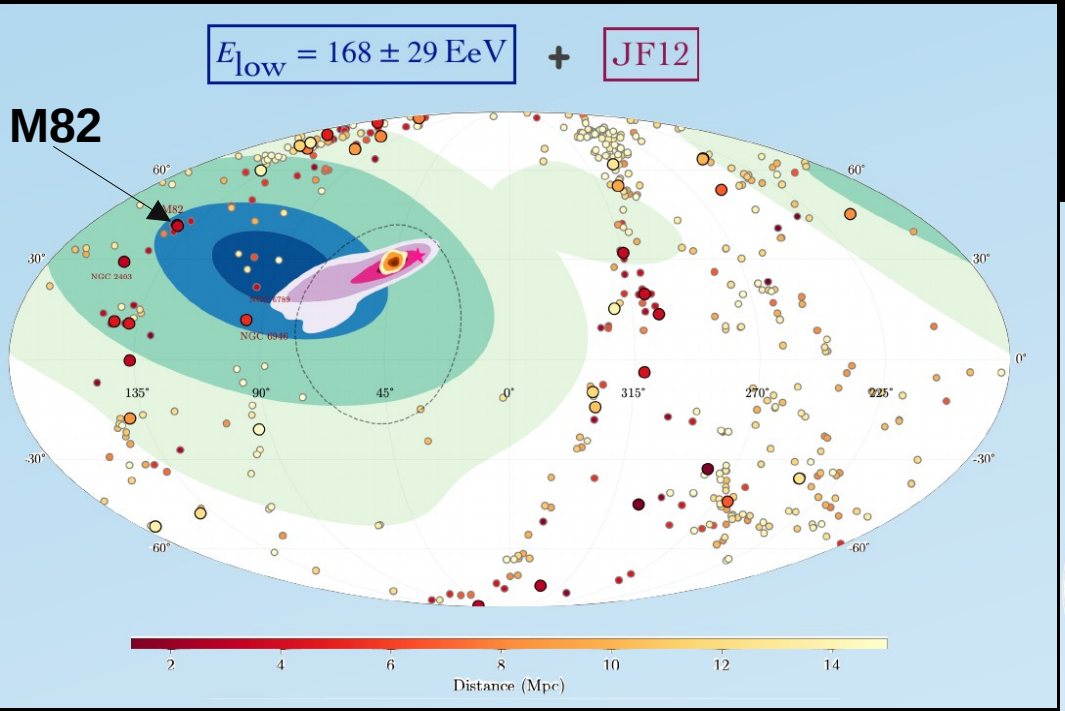
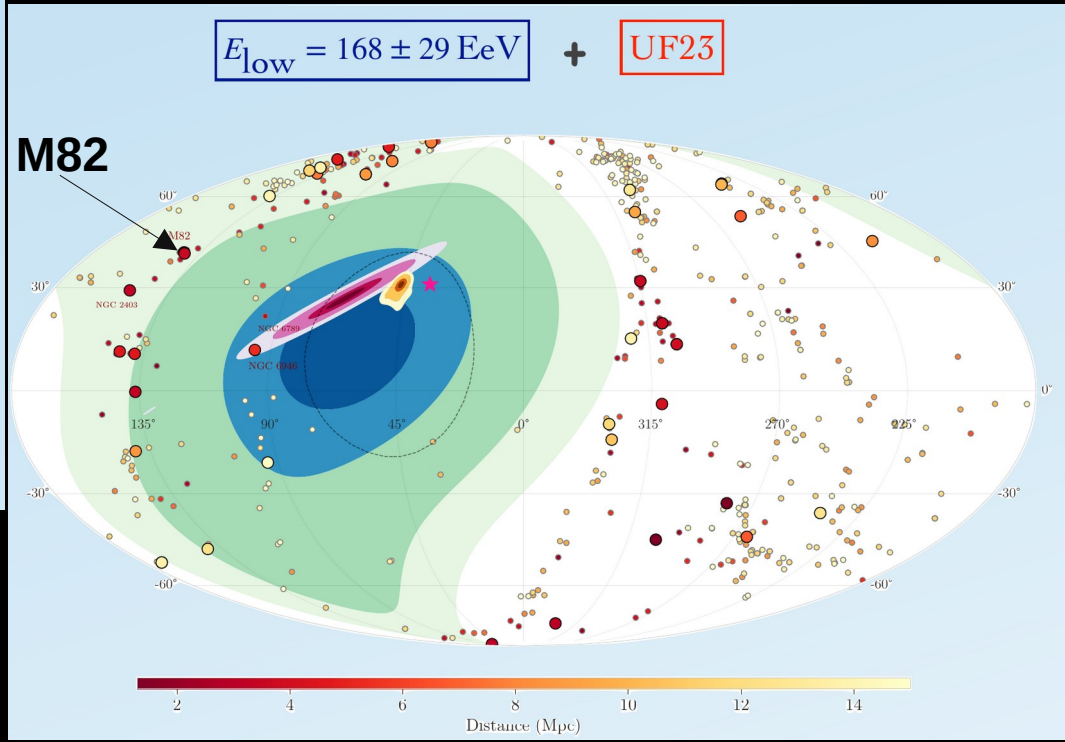


They find multiple possible sources, including several starburst galaxies, like **M82**



Phenomenology

1. **Multimessenger constraints on the UHECR source evolution in the AugerPrime era**

   Authors: A. Cermenati, R. Aloisio, C. Evoli, A. Ambrosone, and L. A. Dourado

2. **Light Dark Matter Particle vs Cosmic Reservoirs**

   Author: A. Ambrosone

3. **Oscillations of hypothetical strange stars as an efficient source ultra-high-energy particles**

   Authors: J. Jałocha-Bratek and Ł. Bratek

4. **Ultra-High-Energy Cosmic Rays from Accretion Shocks in Galaxy Clusters**

   Authors: D. Supanitsky and S. Nuza

5. **Global Spline Fit (GSF) 2024**

   Authors: H. Dembinski, R. Engel, A. Fedynitch, and K. Fujisue

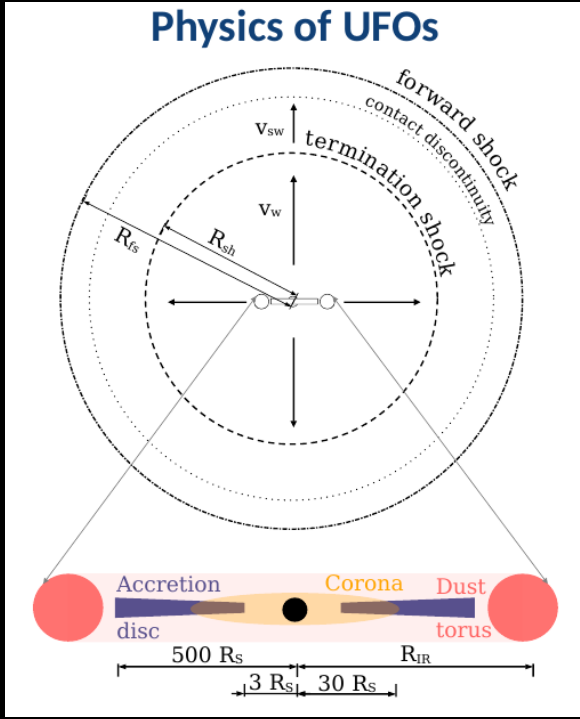
6. **A Heavy-Metal Scenario of UHECR**

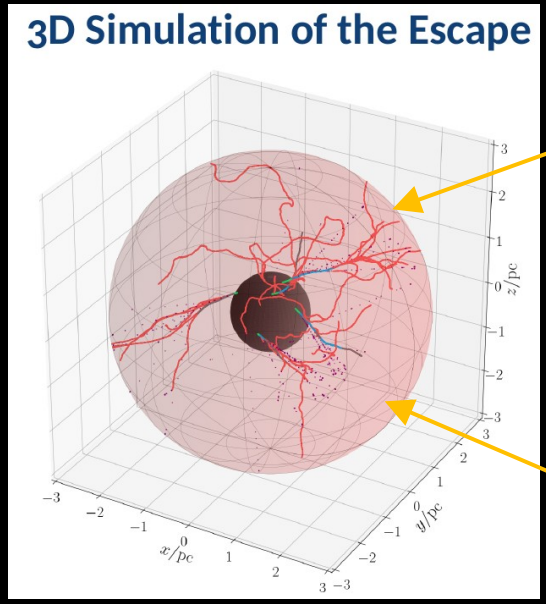
   Authors: J. Vícha , A. Bakalová , O. Tkachenko , A. L. Müller, and M. Stadelmaier

Ultra-high-energy cosmic rays from ultra-fast outflows of active galactic nuclei

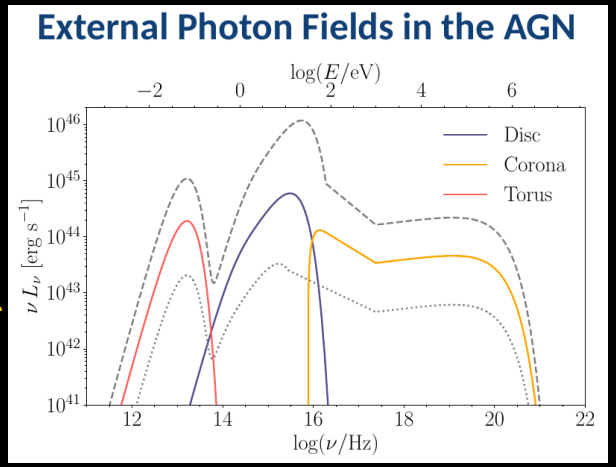
Authors: D. Ehlert, F. Oikonomou, and E. Peretti

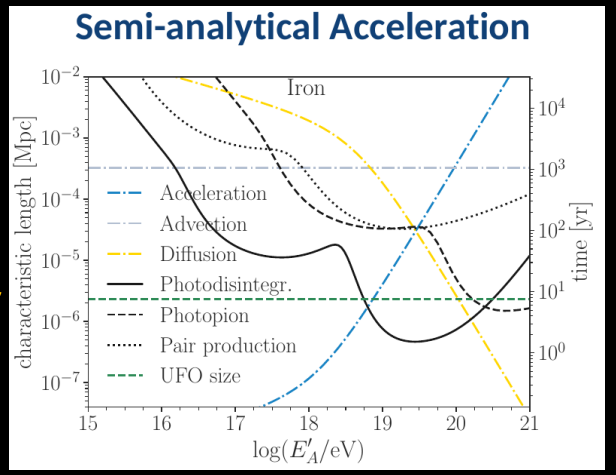
UFOs are present in (50±20)% of jetted and non-jetted AGNs





Maximum energy injected





Ultra-high-energy cosmic rays from ultra-fast outflows of active galactic nuclei

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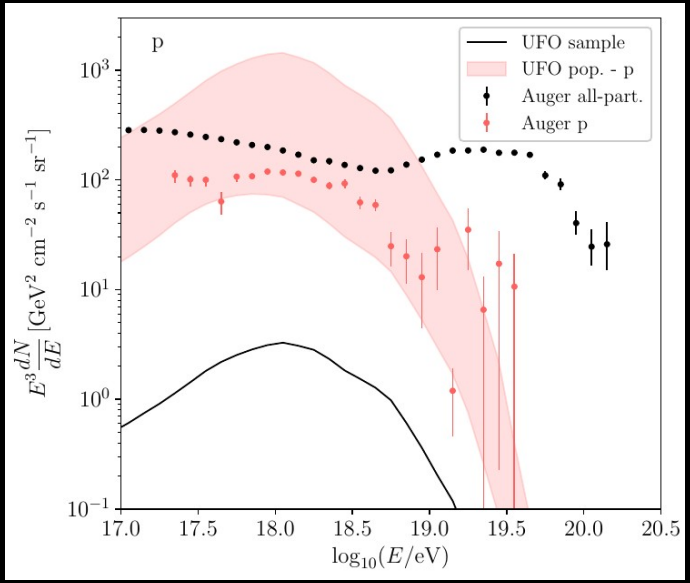
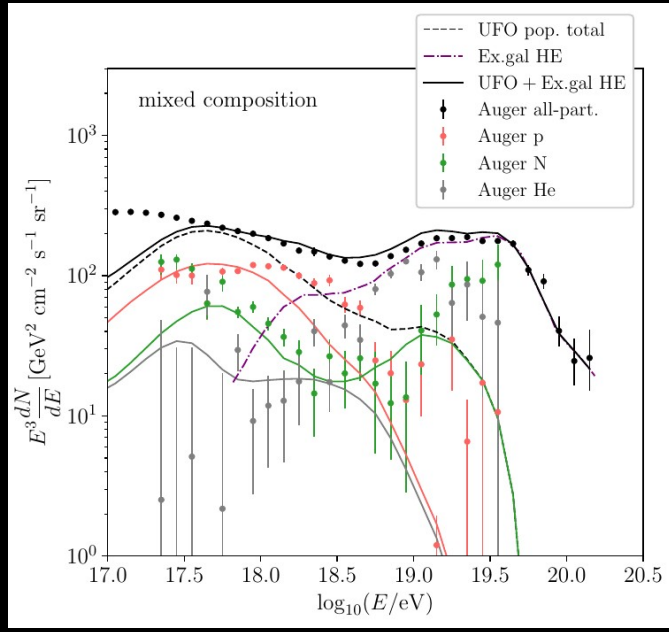
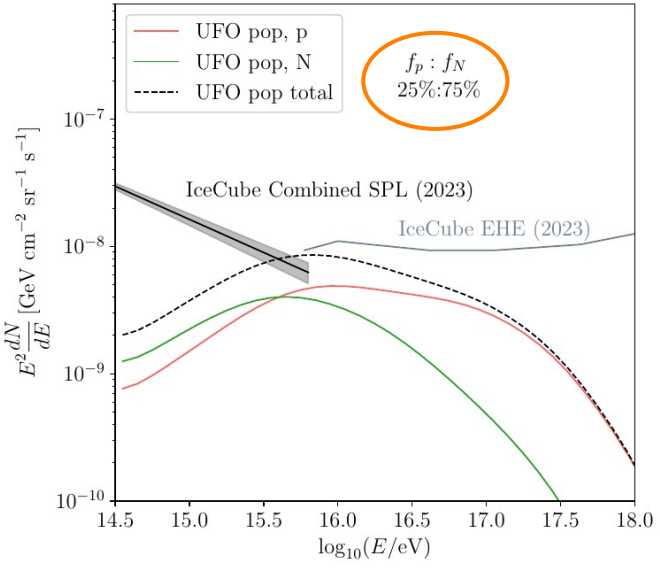


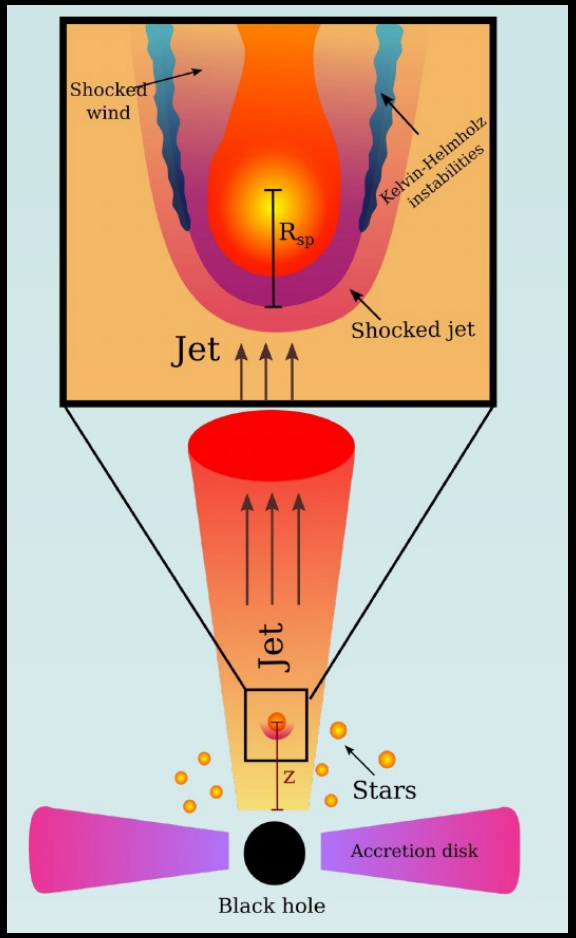
The model can reproduce the low energy component of the flux





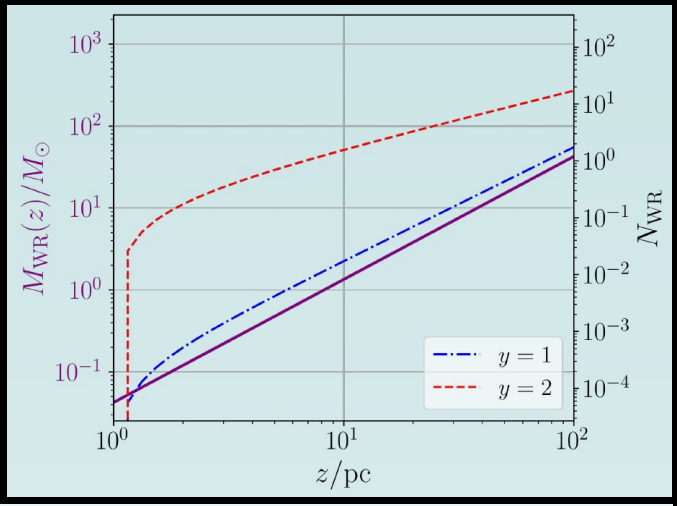
Active Galactic Nuclei Metallicity Enrichment and UHECR Composition

Authors: A. L. Müller and A. Araudo

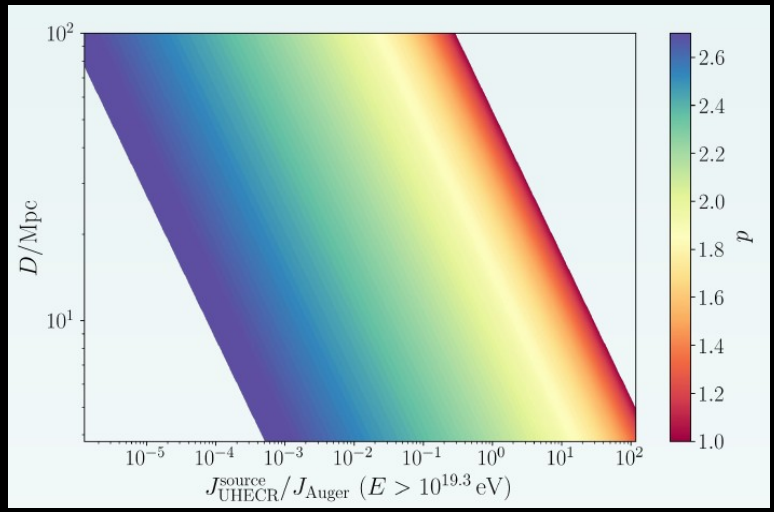


Wolf-Rayet star can enhance the metallicity of an AGN jet

Total mass mixed during the cross of the star (left) and the cumulative number of WR stars inside the jet (right) at a distance z



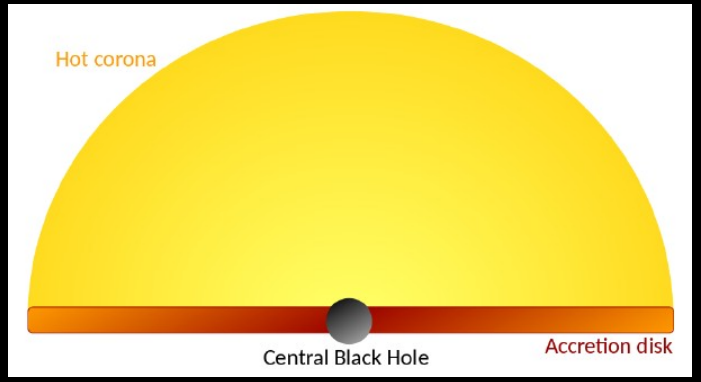
Integral flux above $10^{19.3}$ eV produced by one star in a jet injecting particles with different spectral indexes *p* at different distances D



Are Seyfert Galaxies Truly Neutrino Emitters?

Author: A. Ambrosone

- The IceCube Colaboration have recently found compelling evidence of high energy emission from NGC 1068, a Seyfert galaxy
- Excess from: NGC 4151, CGCG420-015, and NGC 4151, local Seyfert galaxies
- Neutrinos from pp interactions undergone by cosmic-ray and ambient protons of the hot corona

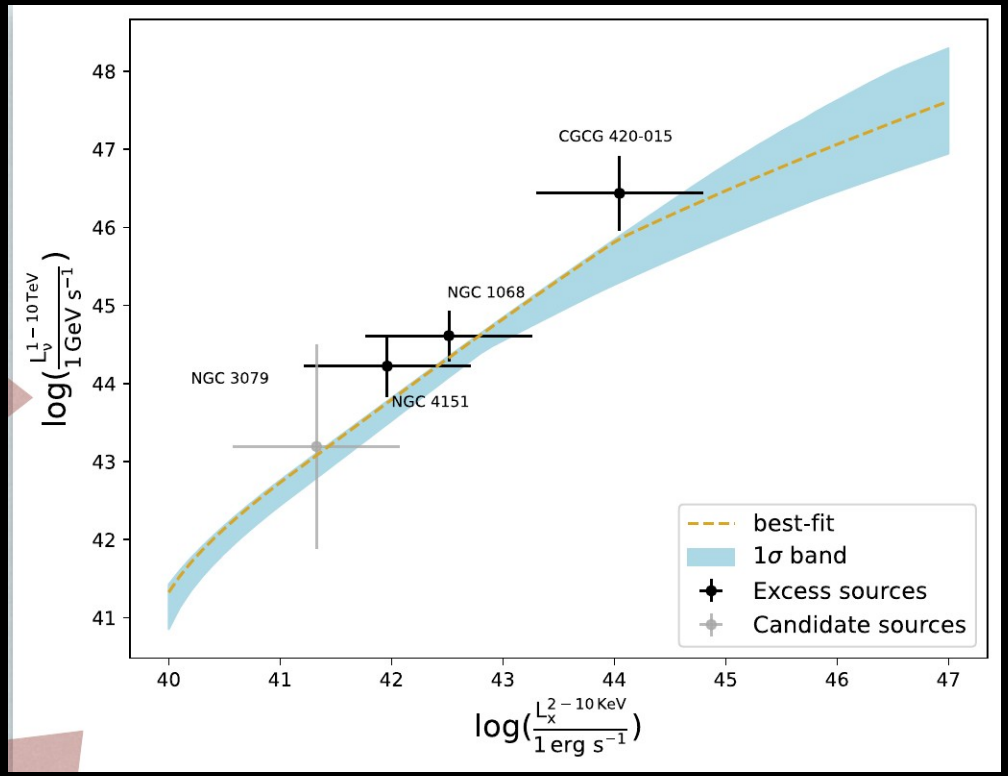


Fraction of the bolometric luminosity required:

$$\eta = 25\%$$

Fit of the data: (γ, β)

Ratio between the gas pressure and the magnetic pressure



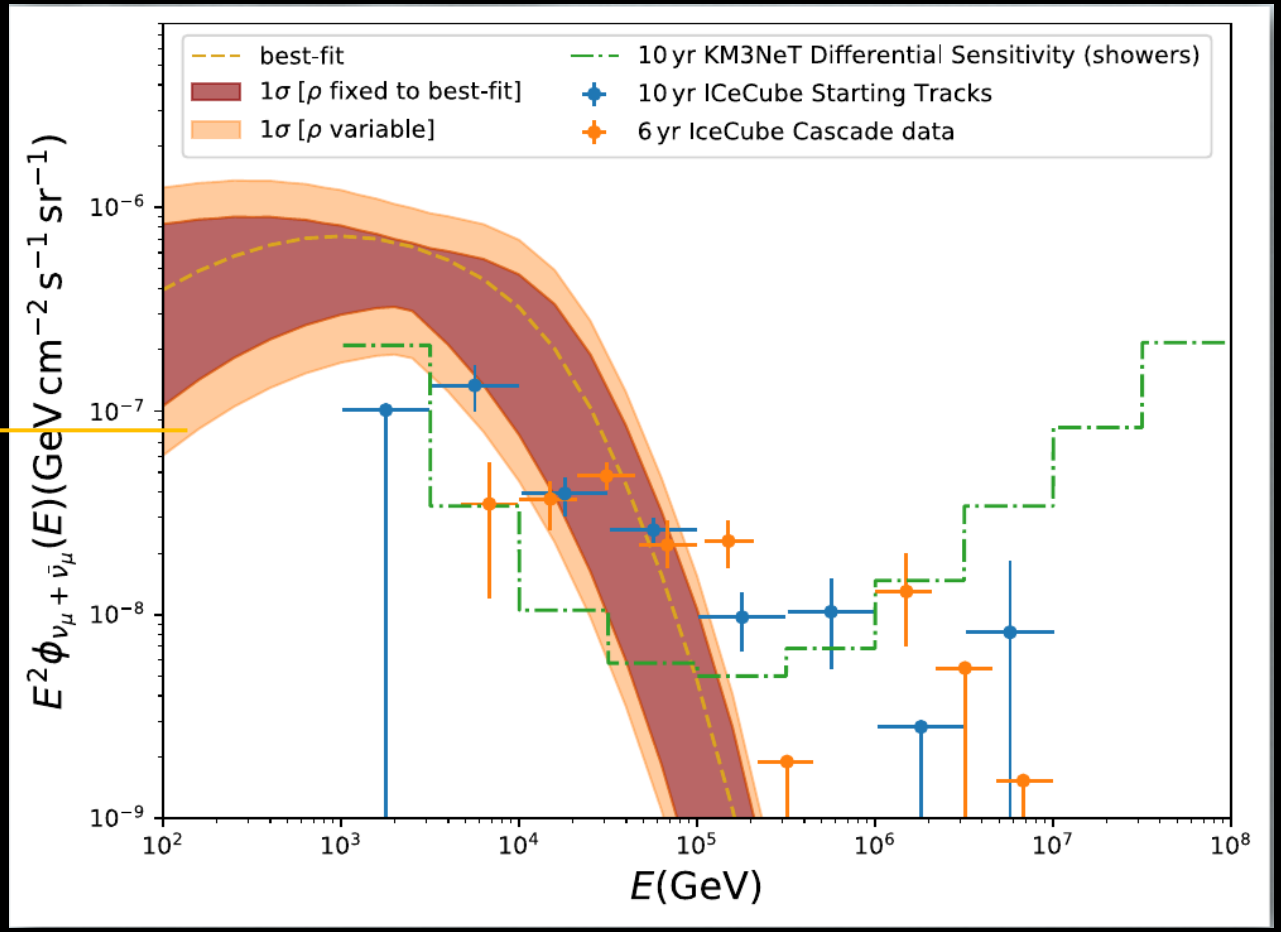
Are Seyfert Galaxies Truly Neutrino Emitters?

Author: A. Ambrosone

The neutrino flux is obtained by using the luminosity function of Seyfert galaxy

Including uncertainties in the luminosity function

Not all Seyfert galaxies can be neutrino emitters. If so, the total flux overshoot the observed neutrino flux



Mass composition, shower physics, and methods for data analyses

1. **Reconstructing Air-Shower Observables Using a Universality-Based Model**

   Authors: M. Stadelmaier, for the Pierre Auger Collaboration

2. **The fractional analysis of mass composition measured by the Telescope Array FADC fluorescence detectors in hybrid mode**

   Authors: D.R. Bergman and J.H. Kim for the Telescope Array Collaboration

3. **Mapping distributions of production variables of UHECR-air interactions onto the (X_{max}, N_μ) space**

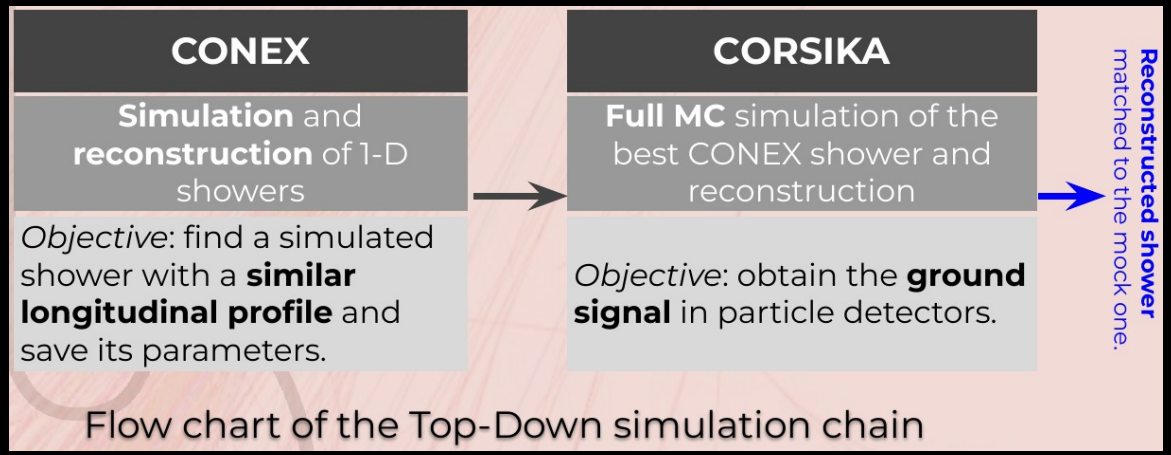
   Authors: L. Cazon, R. Conceiçã, M. Alexandre Martinsa, and F. Riehn

4. **Estimation of Muons on the Surface and Correlation with the Muonic Signal of AugerPrime**

   Authors: C. Perez Bertolli on behalf of the Pierre Auger Collaboration

Rescaling of the muon content of air shower simulations in the context of the Muon Puzzle

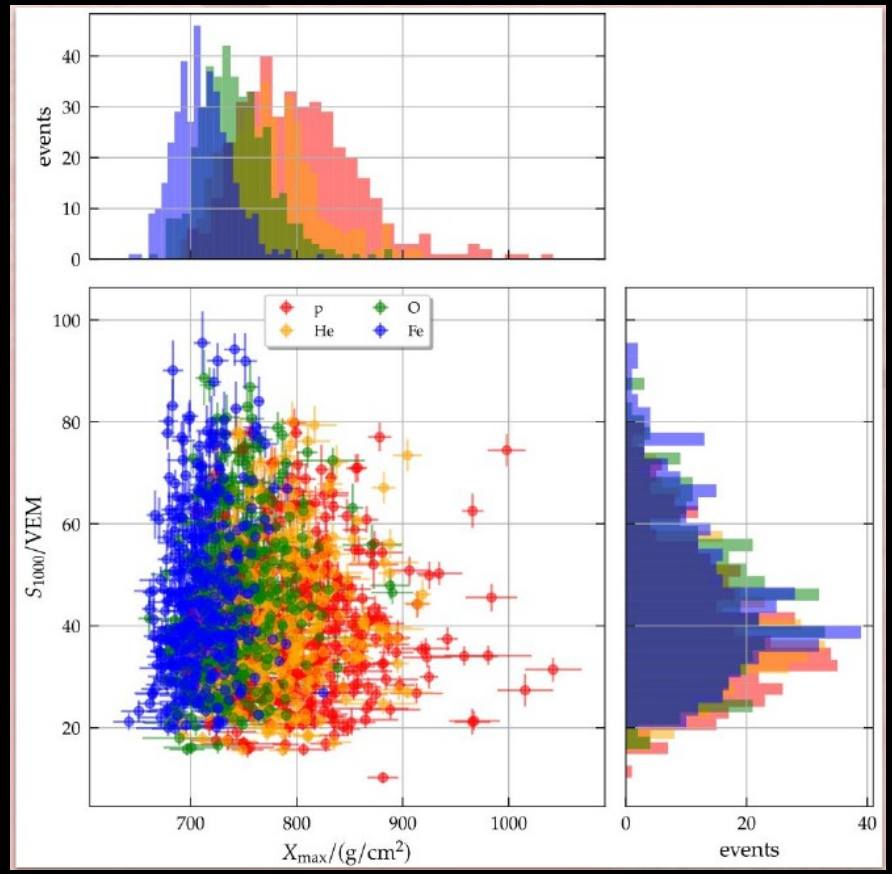
Authors: K. Almeida Cheminant, N. Borodai, R. Engel, D. Gora, J. Pekala, T. Pierog, M. Roth, M. Unger, D. Verberic, H. Wilczynski



Flow chart of the Top-Down simulation chain

Mock data set generated with Sibyll★:

- Primaries: proton, helium, oxygen and iron.
- Energy: 18.8 < lg(E/eV) < 19.2
- Zenith angle: below 60°
- Atmospheres: 4 seasons



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The Mock dataset is processed by using showers generated with Sibyll 2.3d

The scale factor is:

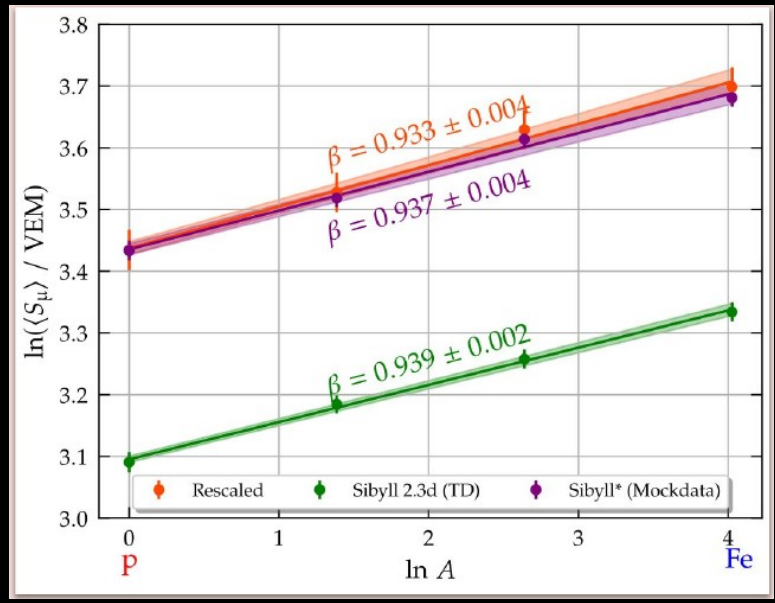
$$\langle r_{\mu,i} \rangle = 1 + \frac{\langle S^{\text{mock.}}_{1000,\text{tot}} \rangle - \langle S^{\text{MC}}_{1000,\text{tot},i} \rangle}{\langle S^{\text{MC}}_{1000,\mu,i} \rangle}$$

$$\langle r_{\mu,i} \rangle = \frac{\langle S^{\text{mock.}}_{1000,\mu,i} \rangle}{\langle S^{\text{MC}}_{1000,\mu,i} \rangle}$$

It is possible to obtain the scale factor accurately

Rescaling factors	proton	helium	oxygen	iron
True	1.41 ± 0.03	1.40 ± 0.03	1.43 ± 0.03	1.42 ± 0.03
From TD	1.41 ± 0.04	1.41 ± 0.04	1.45 ± 0.04	1.44 ± 0.04

It is possible to obtain the beta parameter



Physics beyond the standard model

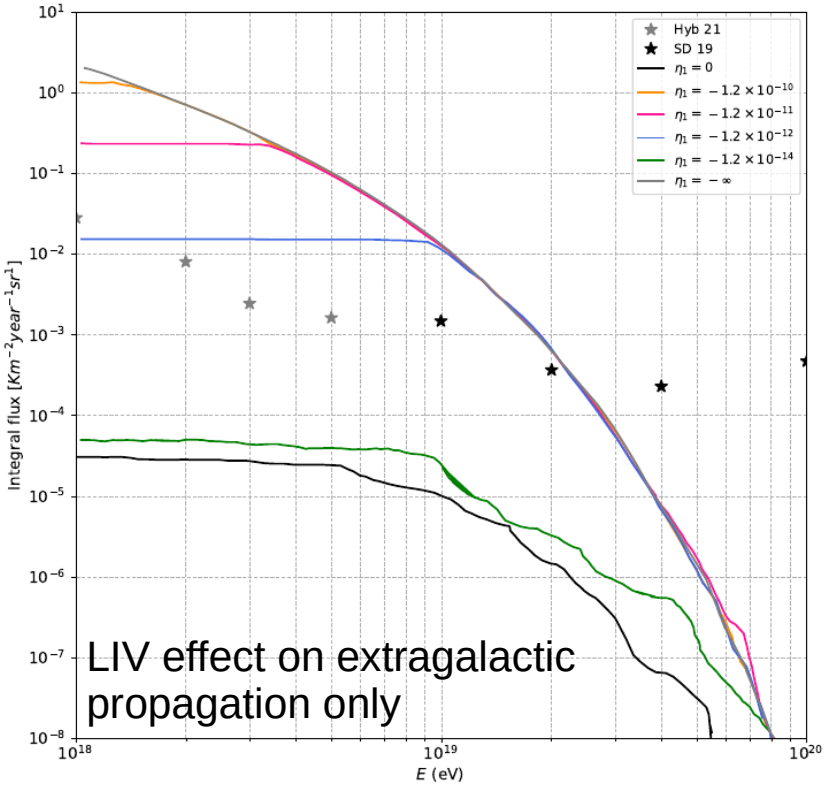
1. **Magnetic Monopoles Theoretical Insights into the Cosmic Ray Conundrum**

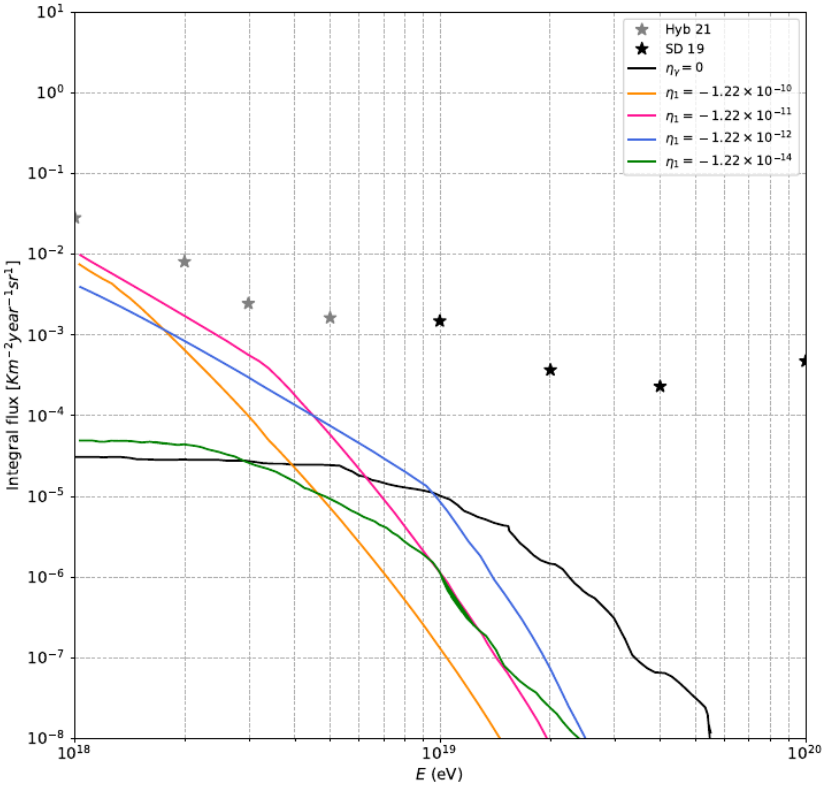
   Authors: Ł. Bratek and J. Jałocha-Bratek

Effect of LIV in the propagation of UHE photons

Authors: P. Morais, D. Boncioli, F. Salamida, P. Lobo, and V. Bezerra

$$E^2 = m^2 + p^2 + \eta \frac{E^3}{M_{\mathrm{PL}}}$$ ⟸ LIV term





Including the suppression factor, due to LIV, that takes into account the generation of an EM shower in the atmosphere

Conclusions

- I have reviewed 29 poster contributions (group 2)
- They are all very interesting
- I am looking forward to read the proceedings!!!

Thank you!!