Cosmogenic Neutrinos in KM3NeT



Dominik Stransky KM3NeT General Meeting, LNS Catania 21.02.2012







Content



- cosmogenic neutrino flux
- atmospheric background
- expected event rates
- summary and outlook



21.02.2012

Cosmogenic neutrino flux

Neutrinos are produced when UHECR interact with CMB:



21.02.2012

KM3NeT General Meeting, LNS Catania

Atmospheric neutrino flux



Neutrinos are produced when cosmic rays interact with matter in the atmosphere:



KM3NeT General Meeting, LNS Catania

21.02.2012

Atmospheric neutrino flux



example plot showing difference between atm. ν_e and ν_μ neutrino flux compared with the cosmogenic flux models:





KM3NeT General Meeting, LNS Catania

Neutrino cross section at high energies KM3Ne1 σ / m² ⊽_e' v - CC v - NC 10⁻³⁵ **Glashow-Resonance** at ⊽ - NC E = 6.3 PeV10⁻³⁶ 10⁻³⁷ 10⁻³⁸ 10-39 10⁶ 10⁷ 10⁸ 10⁹ 10¹⁰ 10¹¹ 10⁵ 10¹² Energy/GeV CC and NC cross sections from: A. Cooper-Sarkar, P. Mertsch, S. Sarkar [arXiv:1106.3723v1] "The high energy neutrino cross-section in the Standard Model and its uncertainty" ERLANGEN CENTRE FOR ASTROPARTICL

21.02.2012

KM3NeT General Meeting, LNS Catania





KM3NeT General Meeting, LNS Catania

Event rates in KM3NeT



KM3Ne¹

KM3NeT General Meeting, LNS Catania

Cumulative event rates

Number of events from a given energy:





KM3Ne[®]

KM3NeT General Meeting, LNS Catania

Dominik Stransky

21.02.2012

Smearing of events

smearing the events with a gaussian as a model for the energy resolution of the detector:

$$\frac{dN_{sm}}{d\log(E)} = \frac{1}{\sqrt{2\pi\sigma^2}} \int_{-\infty}^{+\infty} \frac{dN}{d\log(E')} \cdot e^{-\frac{(\log(E) - \log(E'))^2}{2\sigma^2}} d\log(E'), \ \sigma = 0.3$$

also consider hadronic shower energy is only yE_{y} :







Smeared event rates

The smeared event rates with and without the glashow resonance:



21.02.2012

KM3NeT General Meeting, LNS Catania

Dominik Stransky

KM3Ne1



The smeared cumulative event rates with and without the glashow resonance:

Smeared cumulative event rates



Summary



- depending on the cosmogenic flux model we have 0.4-10 events of cosmogenic neutrinos from E~0.2 PeV per year in the sensitive volume of the telescope
- taking smearing into account we get shower event numbers of 0.25-8.5 per year at energies from E~0.14 PeV
- a few years of measurements would put strong constraints on the parameter space of the cosmogenic flux
- most optimistic atmospheric prompt models can be excluded by the measurements of AMANDA and IceCube



Outlook



- full simulation of contained events in KM3NeT:
 - trigger efficiency
 - reconstruction efficiency
 - energy reconstruction
- include non-contained and non-shower events in our studies, i.e. ν_{μ} and ν_{τ} events
- calculation of the model independent differential sensitivity and of the discovery potential of KM3NeT to the diffuse cosmogenic flux







Thank you very much for your attention.

GEFÖRDERT VOM



Bundesministerium für Bildung und Forschung



21.02.2012

KM3NeT General Meeting, LNS Catania

Comparison of non-smeared and smeared numbers



Differential event rate without glashow resonance:



KM3NeT General Meeting, LNS Catania

Comparison of non-smeared and smeared numbers



Differential event rate with glashow resonance:



Comparison of non-smeared and smeared numbers



Cumulative event rate without glashow resonance:



21.02.2012

KM3NeT General Meeting, LNS Catania

Comparison of non-smeared and smeared numbers



Cumulative event rate with glashow resonance:

