利用方向-能量重建探测 K-40 地球中微子

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地球中微子通量计算

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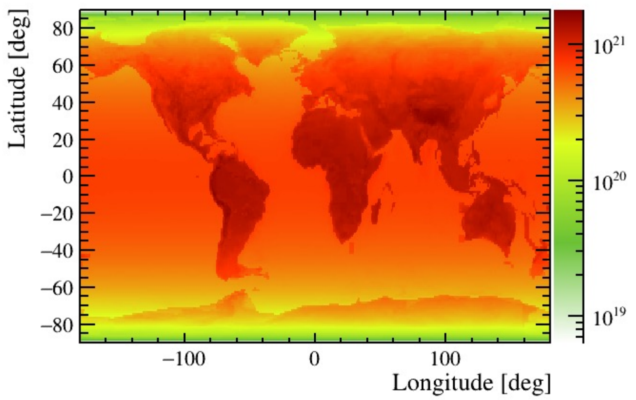
地球中微子通量计算

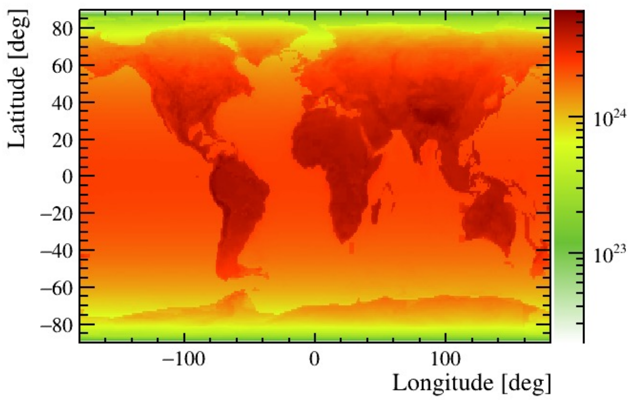
- 由模型给出不同格点的密度、元素含量
- 计算该格点放出中微子数
- 按照距离计算锦屏处的通量
- 振荡概率
- 锦屏位置
  - (28.15323°N，101.7114°E，海拔1500 m)

$$d\phi(\vec{r})_e = \frac{X\lambda N_A}{\mu} n_\nu P_{ee}^{\oplus} \frac{A(\vec{r})\rho(\vec{r})}{4\pi|\vec{r}-\vec{d}|^2} dv,$$

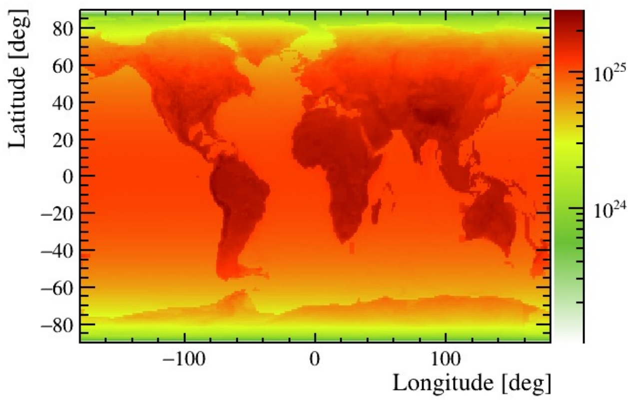
放射性核素分布



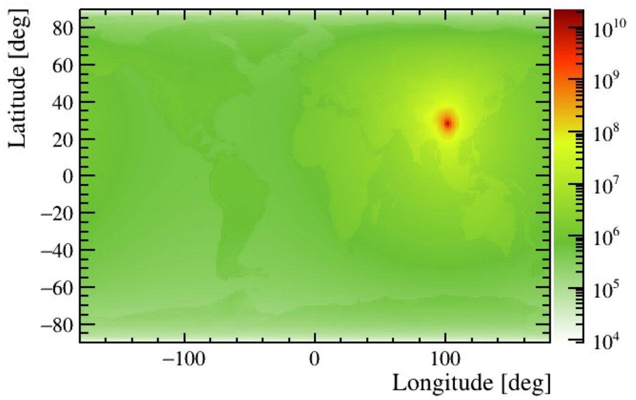
K40 NeutrinoRate



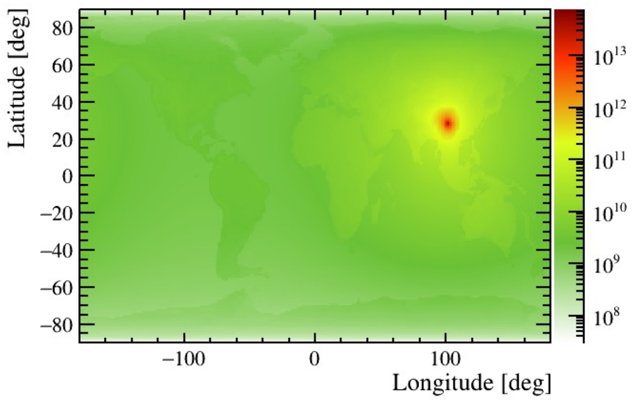
Th232 NeutrinoRate



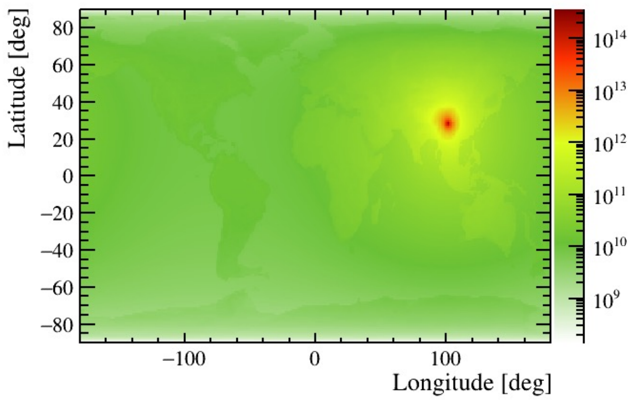
U238 NeutrinoRate



K40 NeutrinoFlux



Th232 NeutrinoFlux



U238 NeutrinoFlux

地球中微子通量计算

Hunting the Potassium Geoneutrinos with Liquid Scintillator Cherenkov Neutrino Detectors

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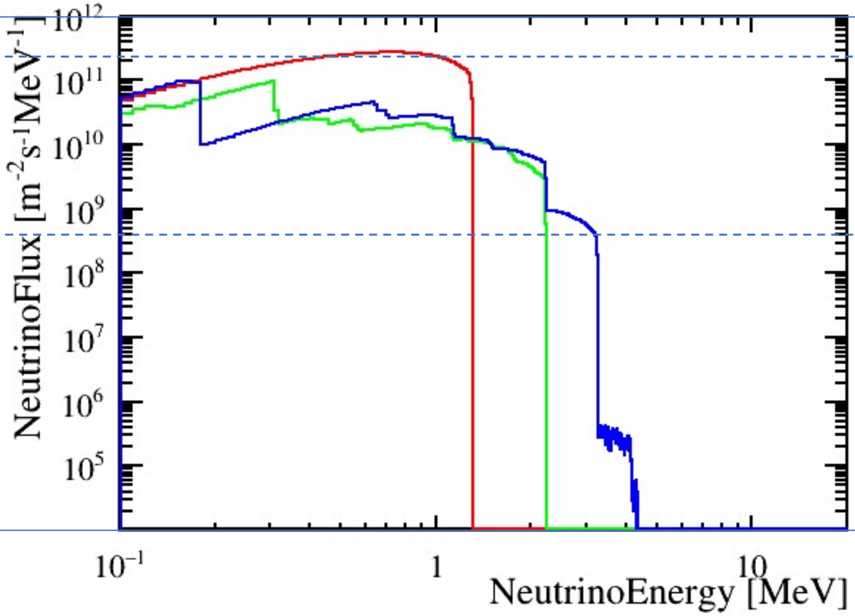


地球中微子通量（无振荡）

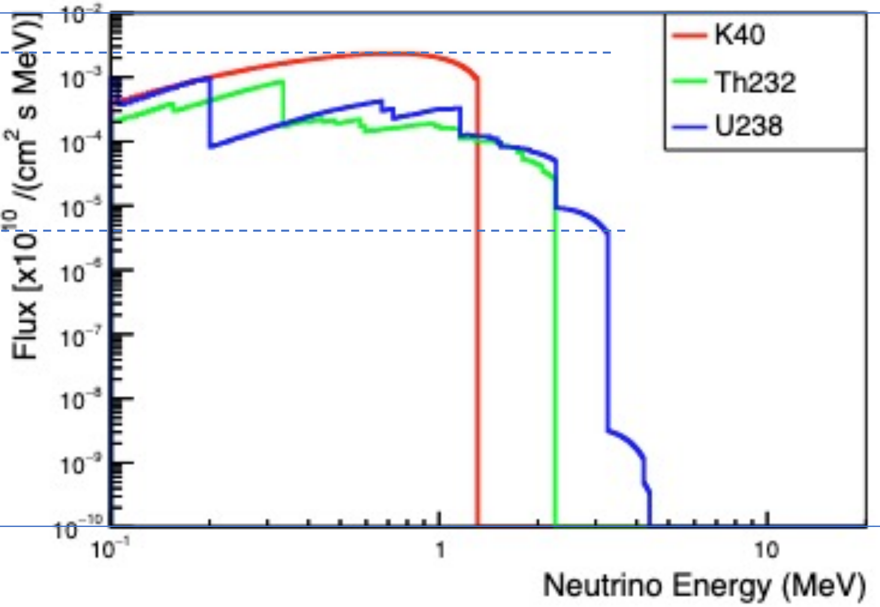
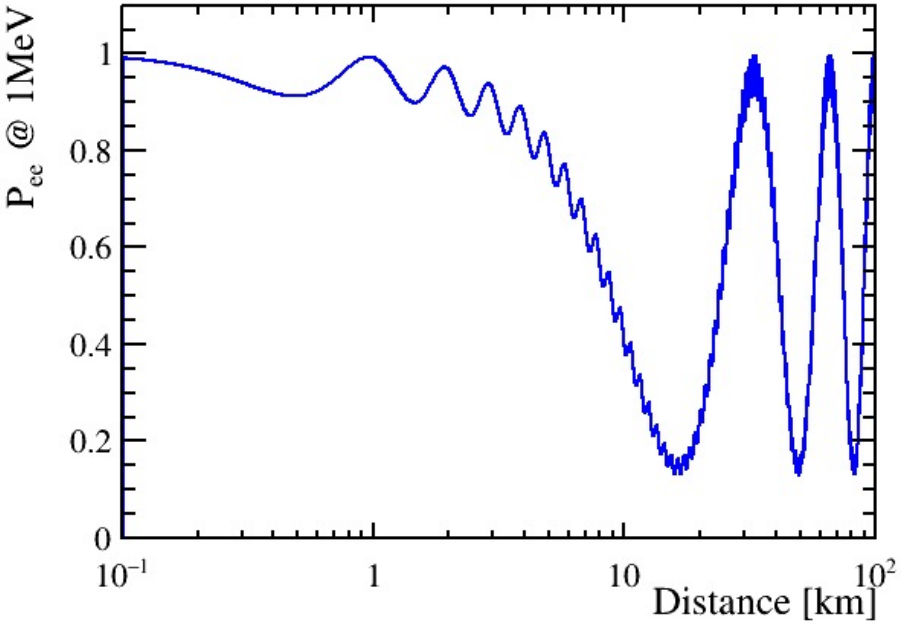
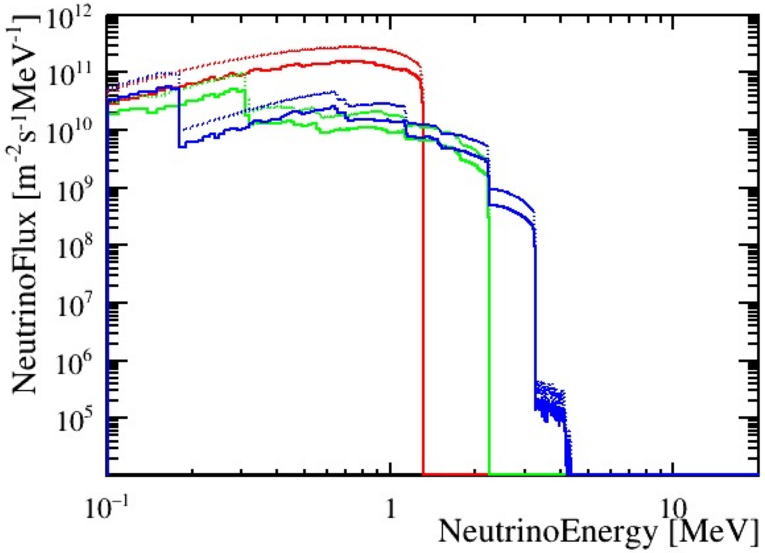


Figure B.15: Predicted non-oscillating geo electron-antineutrino energy spectra on the Earth's surface.

中微子振荡



电子型(反)中微子存活概率
振荡周期～30km@1MeV



振荡前后中微子能谱

中微子IBD事例率（未细化分网格）

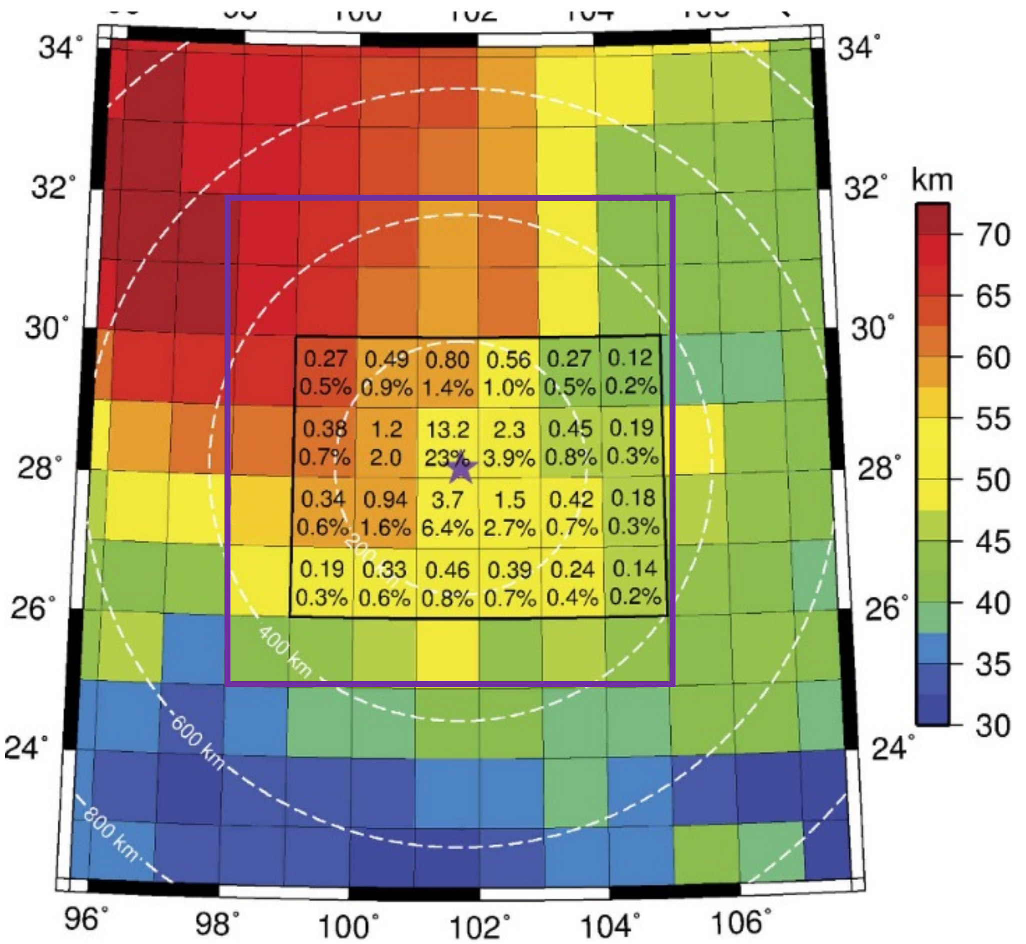
TABLE V. Summary of predicted geoneutrino event rates in TNU at Jinping.

Geo $\bar{\nu}_e$ (TNU)	Crust	Mantle	BSE
Th	10.6 ± 0.8	2.1 ± 0.5	12.7 ± 1.0
U	38.4 ± 6.6	8.3 ± 2.3	46.7 ± 6.7
Th + U	49.0 ± 7.3	10.4 ± 2.7	59.4 ± 7.6

	Curst	Mantle	Total
Th232	7.06	2.44	9.51
U238	26.21	9.98	36.19
Total	33.27	12.42	45.70

- 近点计算精度
  - 近点贡献较大
  - 振荡周期～30km@1MeV
  - 1°～111km
  - 岩层厚度～20km

精细划分网格



- 靠近的网格贡献较多的事例数
- 对靠近的7°*7°网格更精细划分
  - 将每一块划分为1000块

中微子IBD事例率（细化分网格）

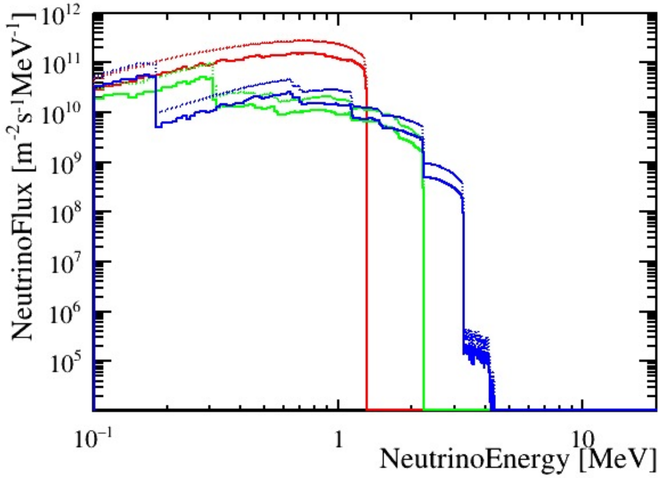
TABLE V. Summary of predicted geoneutrino event rates in TNU at Jinping.

Geo $\bar{\nu}_e$ (TNU)	Crust	Mantle	BSE
Th	10.6 ± 0.8	2.1 ± 0.5	12.7 ± 1.0
U	38.4 ± 6.6	8.3 ± 2.3	46.7 ± 6.7
Th + U	49.0 ± 7.3	10.4 ± 2.7	59.4 ± 7.6

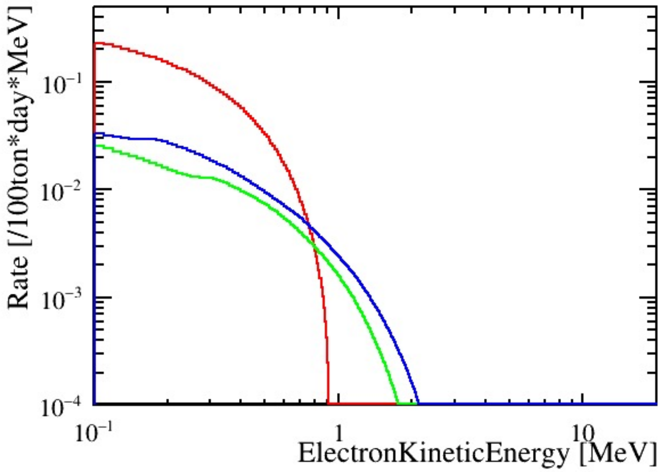
	Curst	Mantle	Total
Th232	8.50(7.06)	2.49(2.44)	10.99(9.51)
U238	33.01(26.21)	10.18(9.98)	43.20(36.19)
Total	41.51(33.27)	12.67(12.42)	54.19(45.70)

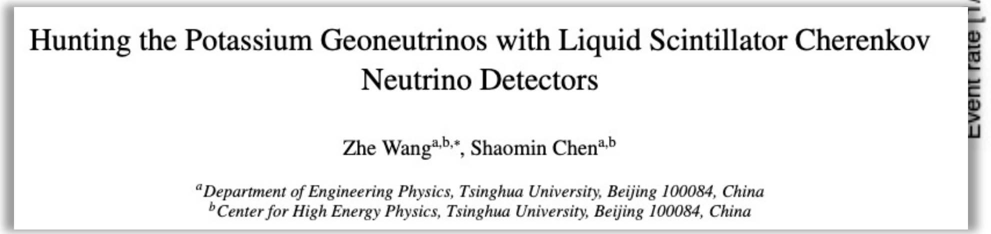
- 仍有～20%差异
- 再检查

反冲电子能谱



$$\frac{dN}{dT} = N_e \int [\sum_{\nu} \frac{d\sigma(E_\nu, T_e)}{dT_e} P_{ev}] F(E_\nu) dE_\nu,$$

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