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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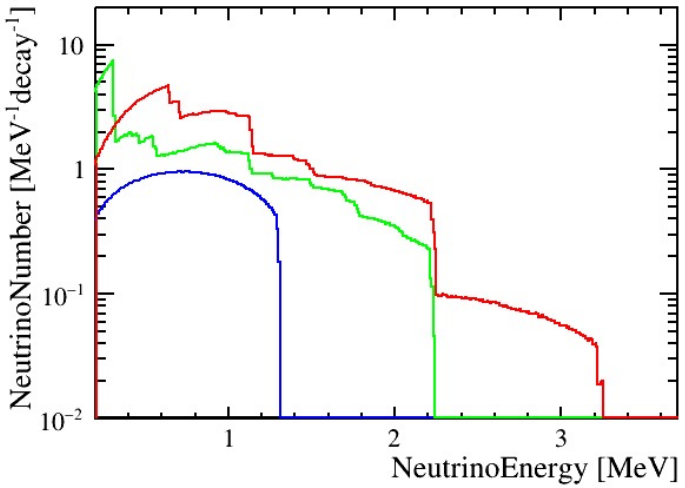
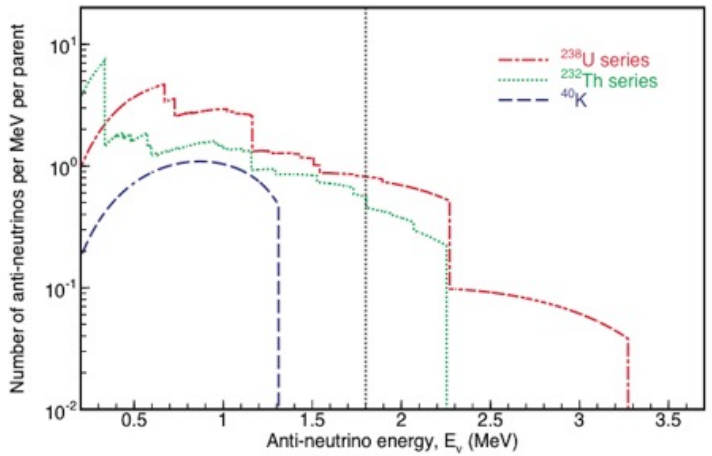
- K40 Th232 U238衰变中微子能谱
- 地球模型
- 地球中微子通量计算

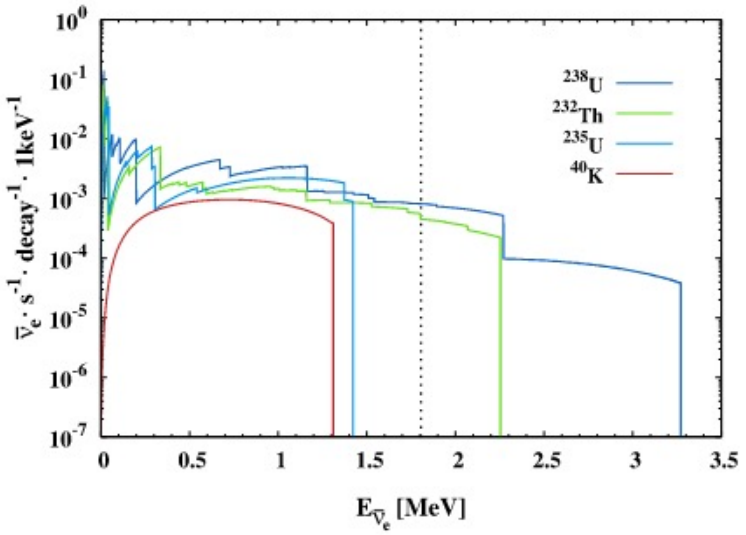
K40 Th232 U238衰变中微子能谱

红色：U238
绿色：Th232
蓝色：K40





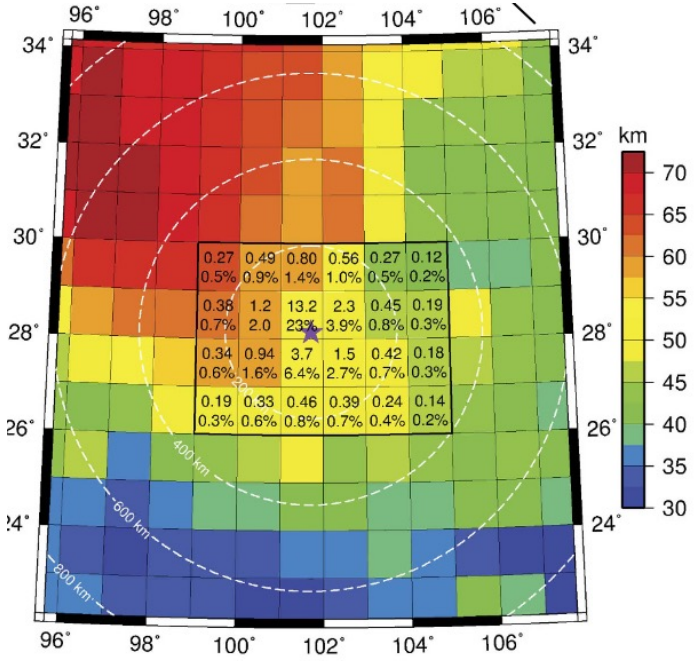
KamLAND

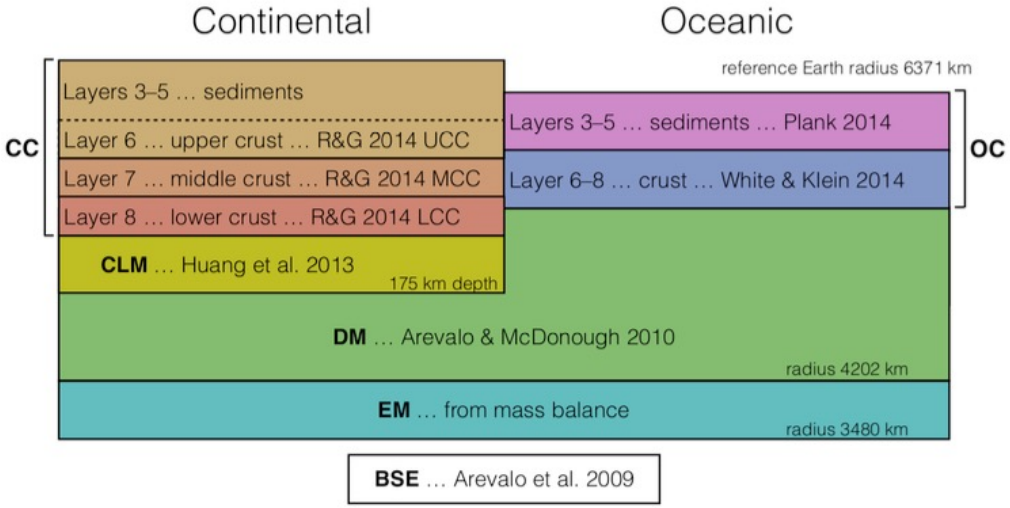


Borexino

地球模型

- 地壳 Crust1.0
  - 1deg x 1 deg
  - 8 layers
- 地幔
  - CLM DM EM
- 元素含量
- 依据文献





	K	Th	U	Ref.
Upper CC + sediments	$(2.32 \pm 8\%) \times 10^{-2}$	$(10.5 \pm 10\%) \times 10^{-6}$	$(2.7 \pm 21\%) \times 10^{-6}$	64
Middle CC	$(1.91 \pm 14\%) \times 10^{-2}$	$(6.5 \pm 8\%) \times 10^{-6}$	$(1.3 \pm 31\%) \times 10^{-6}$	64
Lower CC	$(0.51 \pm 30\%) \times 10^{-2}$	$(1.2 \pm 30\%) \times 10^{-6}$	$(0.2 \pm 30\%) \times 10^{-6}$	64
OC sediments	$(1.83 \pm 7\%) \times 10^{-2}$	$(8.10 \pm 7\%) \times 10^{-6}$	$(1.73 \pm 5\%) \times 10^{-6}$	69
OC crust	$(716 \pm 30\%) \times 10^{-6}$	$(0.21 \pm 30\%) \times 10^{-6}$	$(0.07 \pm 30\%) \times 10^{-6}$	70
CLM	$315^{+432}_{-183} \times 10^{-6}$	$150^{+277}_{-97} \times 10^{-9}$	$33^{+49}_{-20} \times 10^{-9}$	15
Depleted Mantle	$(152 \pm 20\%) \times 10^{-6}$	$(21.9 \pm 20\%) \times 10^{-9}$	$(8.0 \pm 20\%) \times 10^{-9}$	71
Enriched Mantle*	$402^{+350}_{-238} \times 10^{-6}$	$147^{+74}_{-57} \times 10^{-9}$	$30^{+24}_{-18} \times 10^{-9}$	
Bulk Silicate Earth	$(280 \pm 21\%) \times 10^{-6}$	$(80 \pm 15\%) \times 10^{-9}$	$(20 \pm 20\%) \times 10^{-9}$	72

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Geoneutrinos at Jinping: Flux prediction and oscillation analysis

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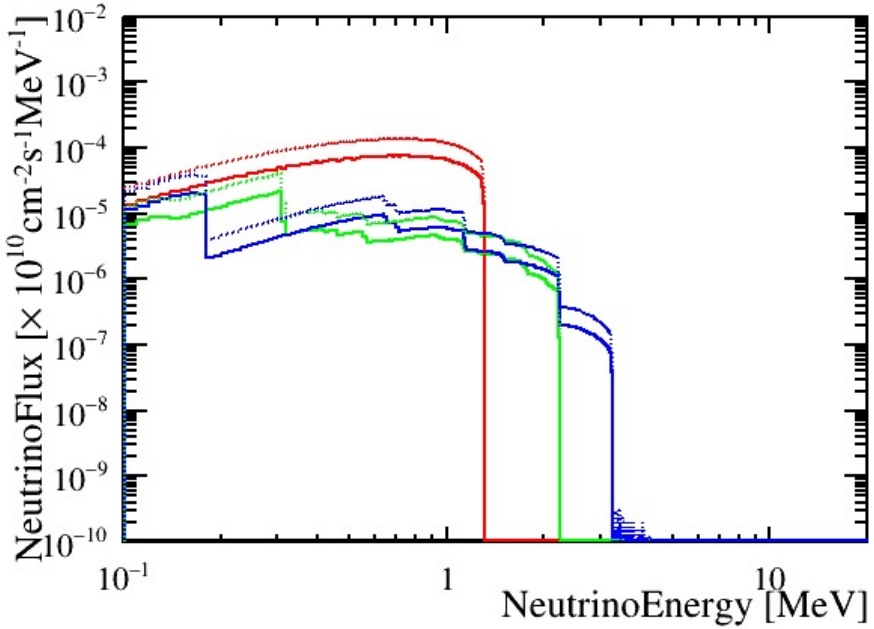
地球中微子通量计算

- 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
- 按照立体角计算锦屏处的通量
- 锦屏位置
  - (28.15323° N，101.7114° E，海拔1500 m)

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

地球中微子通量计算

相差大约1个数量级
使用的元素含量、地球模型有些不同



点线：不考虑振荡
实线：振荡后

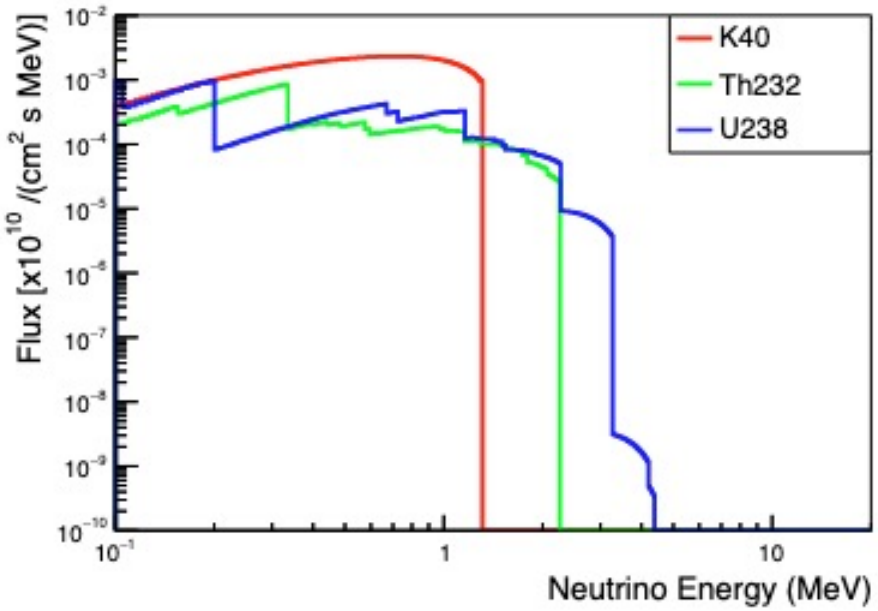


Figure B.15: Predicted non-oscillating geo electron-antineutrino energy spectra on the Earth's surface.

地球中微子通量计算

- 程序可能有bug

- 后续可以对比的量
  - 用matlab计算结果
  - Pee’
  - 地壳、地幔中微子总通量