# F / Dark Matter Search with Emulsion F D2

#### F





主





The Generations of Matter 主

1998

#### DONUT

 $\begin{array}{c} \nu_{\mu} \rightarrow \nu_{\tau} \\ OPERA \end{array}$ 

2



0.16/crystal 3





# F

### **OPERA**

Target Area Muon Spectrometer



3

#### $1^{st} v_{\tau}$ event candidate



# GRAINE



- •
- •
- 2014

下 50m<sup>2</sup> 下 m<sup>2</sup>



# **Directional Dark Matter**

# **Directional Dark Matter**

### Emulsion

- Target CNO, AgBr
- Target Mass large
- Angular Resolution < 35
- BG rejection
  - proton,  $\alpha$ -ray(tracking)
  - $-\gamma/e^{-}$  ( dE/dx
  - Random Fog (



<sup>&</sup>lt;400nm

### Emulsion DM



### DM



500nm

#### • selection

- X-ray
- Plasmon analysis







60µm

- $\alpha$ -ray  $\rightarrow$  tracking
- keV~ neutron recoil
- $\beta, \gamma \rightarrow Fog signal$
- Fog (random noise)
  - BG • (β)

rejection

Fog



### Fog like BG - rough estimation

#### RI

- ${}^{40}\text{K}\beta$ -ray 9  $10^{7}/\text{kg/day}$  Ge )
  - 99% AgBr KBr $\rightarrow$ NaBr
  - 1%
- <sup>40</sup>K 不

•  ${}^{14}C \beta$ -ray 5  $10^{6}/kg/day$ 

$$( ) \rightarrow PVA( )$$

e<sup>-</sup> rejection (Rh dope) rejection power 10<sup>4</sup>
RI

• Fog 
$$10^{10} \sim 11/\text{kg} \rightarrow \text{rejection } 10^2$$
 (

- Fog chance coincidence (200nm threshold)
  - track like 2 Fog  $10^3 \sim \frac{5}{\text{kg}}$
  - track like 3 Fog  $10^{-1} \sim 1/kg$

track

upgrade