

An idea to measure the arrival direction of wavy dark matter using the Moon

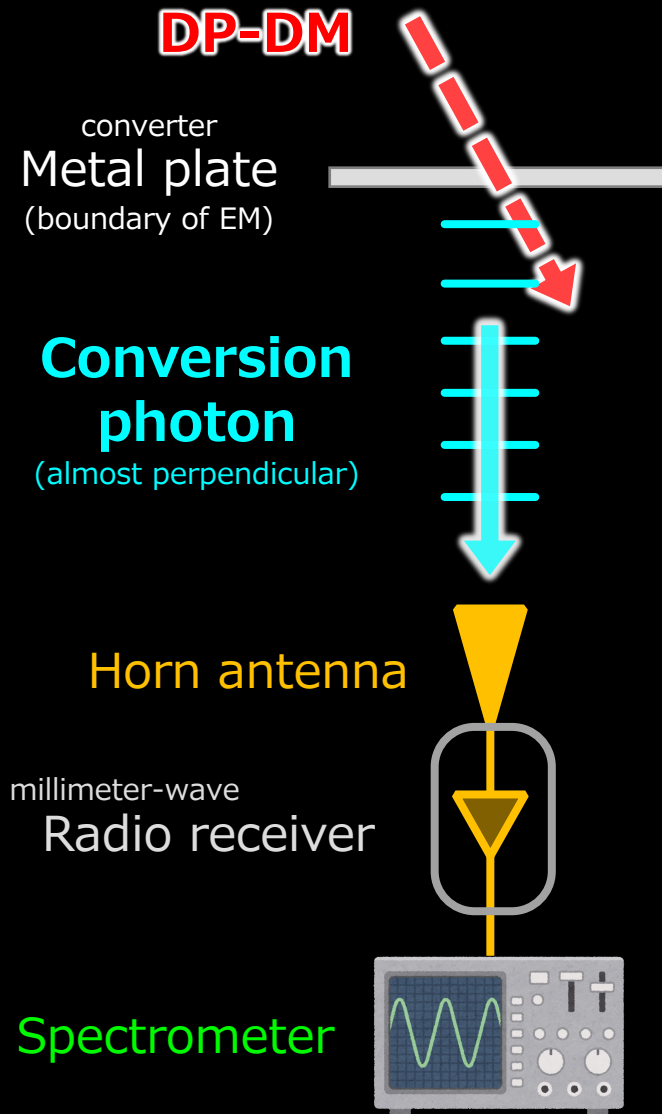
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**After the discovery of wavy-DM signal...
What's next subject?**

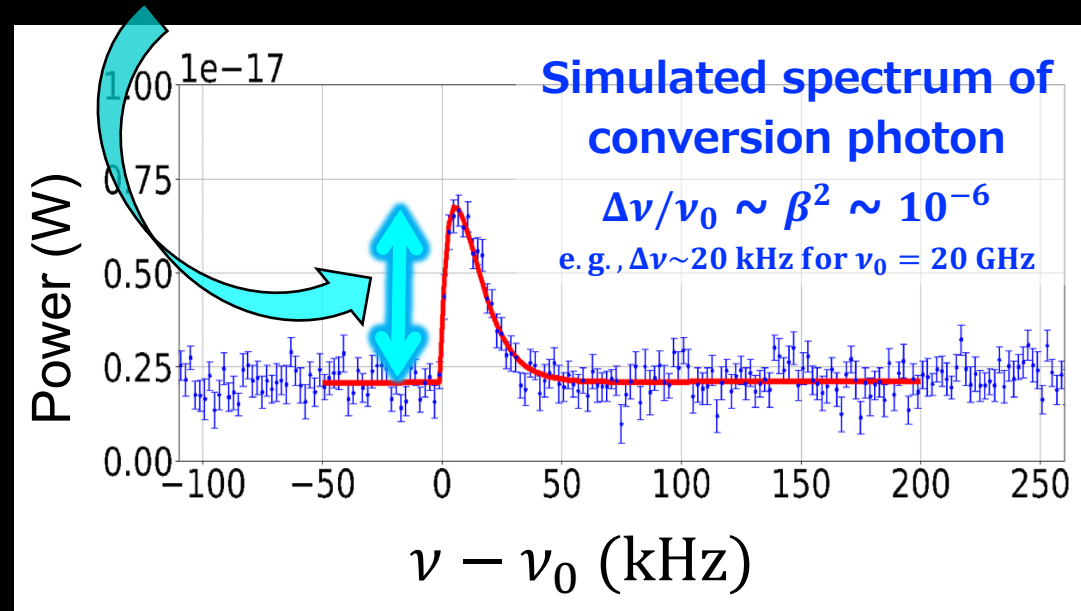
**Arrival
direction!**

Detection principle of DP-DM

D. Horns et al. , JCAP 1304, 016 (2013)



Peak height $\propto \chi^2$



Peak frequency corresponds to mass
 $h\nu_0 \simeq m_{\text{DP}}c^2$ e.g., 20 GHz \leftrightarrow 80 $\mu\text{eV}/c^2$

Need fine angular resolution of 0.01° to identify the arrival direction

Con.

Diffraction limit and far-field condition

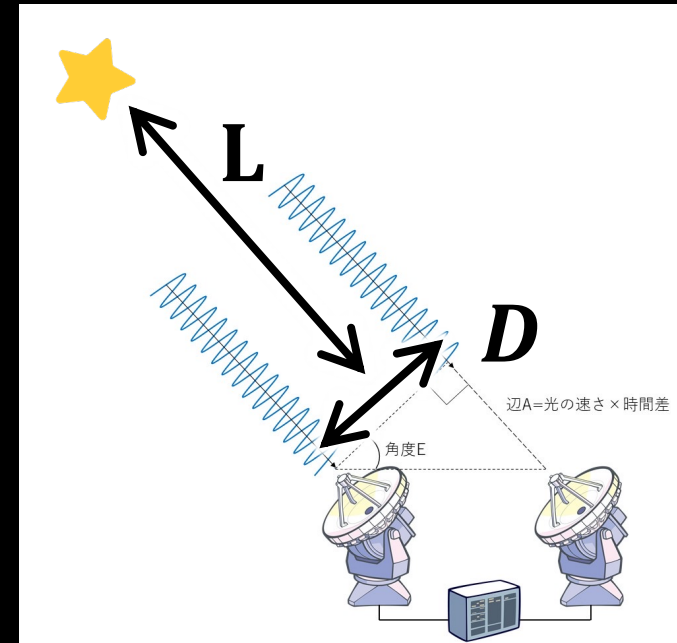
Angular resolution $\sim 0.01^\circ$

$$\Omega \simeq \frac{\lambda}{D} \rightarrow D \simeq \frac{\lambda}{\Omega} \sim 100 \text{ m}$$

$$L = \frac{2D^2}{\lambda}$$

$$\rightarrow L \simeq \frac{2 \times (100 \text{ m})^2}{1.2 \text{ cm}} \simeq 1,700 \text{ km}$$

(ref) Alt. of ISS: 408 km



<https://alma-telescope.jp/column/almabasics-2>

Need space-scale setup!

Basic idea: the Moon & the Earth

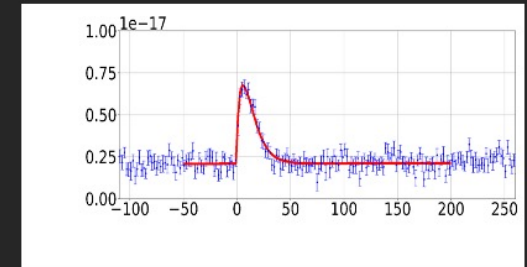
Converter on the Moon

$d_{EM} \approx 380,000$ km

$\theta_M \approx 0.5^\circ$

$r_M \approx 1,700$ km

Receiver on the Earth



Wavy-DM

Conversion photons

From the Earth, we will observe the signal at the Moon center

Wavy-DM

0.06° 2 km

Conversion photons

From the Earth, we will observe the signal at $\sim 1''$ away from the Moon center.

Please come to my poster for further discussions!