

SLAC-PUB-13802

Disentangling Dark Matter Dynamics with Directional Detection

Mariangela Lisanti and Jay G. Wacker¹

¹ *Theory Group, SLAC, Menlo Park, CA 94025*

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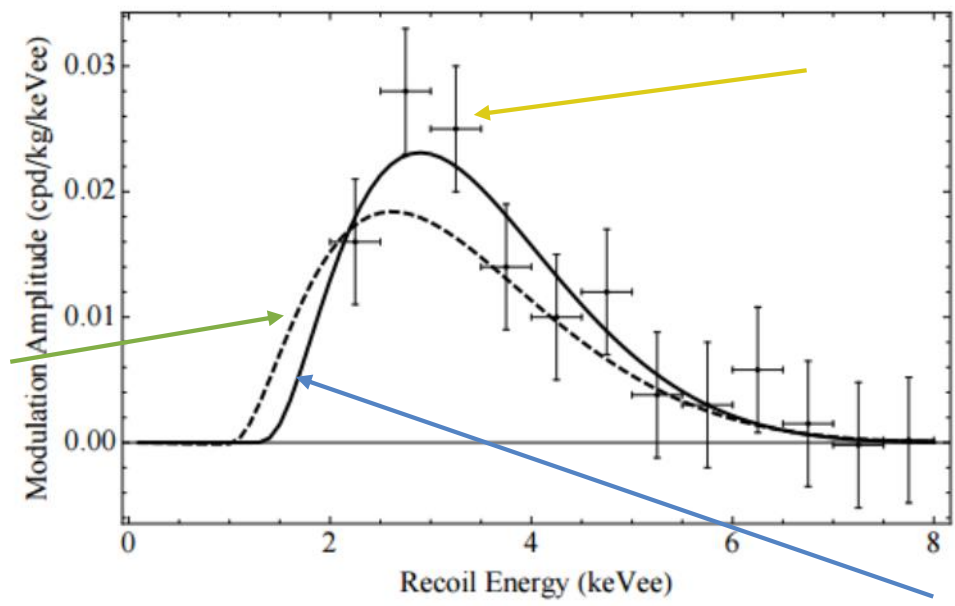
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$$F_{\text{dm}}(q^2) = c_0 + c_1 q^2 + c_2 q^4 + \dots . \quad (1)$$

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$$\frac{dR}{dE_R} = \frac{\rho_0}{m_{\text{dm}} m_N} \left\langle \frac{d\sigma}{dE_R} v \right\rangle, \quad (2)$$

$$\frac{d\sigma}{dE_R} = \left[c_{\text{el}}^2 \left(\frac{2m_N E_R}{\Lambda^2} \right)^{n_{\text{el}}} + c_{\text{in}}^2 \left(\frac{2m_N E_R}{\Lambda^2} \right)^{n_{\text{in}}} \right] \frac{d\sigma_0}{dE_R}, \quad (3)$$

$$|F_{\text{H}}(E_R)|^2 = \left(\frac{3j_1(|q|r_0)}{|q|r_0} \right)^2 e^{-s^2|q|^2}, \quad (5)$$

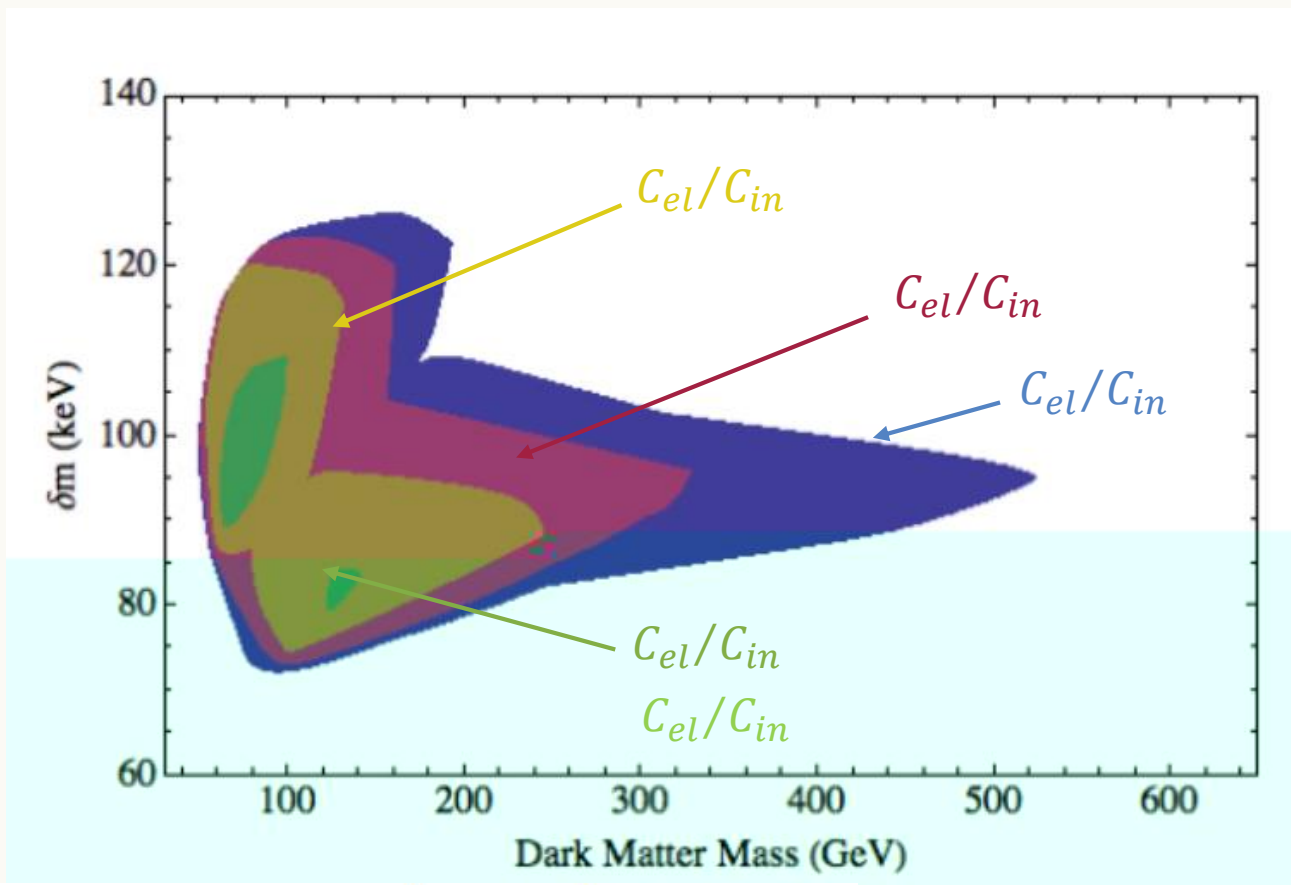
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$$\chi^2(m_{\text{dm}}, \delta m, \sigma_p, v_0, v_{\text{esc}}, \alpha) = \sum_{i=1}^{N_{\text{exp}}} \left(\frac{X_i^{\text{pred}} - X_i^{\text{obs}}}{\sigma_i} \right)^2, \quad (13)$$

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$$\begin{aligned} 200 \text{ km/s} &\leq v_0 \leq 300 \text{ km/s} \\ 500 \text{ km/s} &\leq v_{\text{esc}} \leq 600 \text{ km/s} \\ 0.8 &\leq \alpha \leq 1.25. \end{aligned} \quad (14)$$

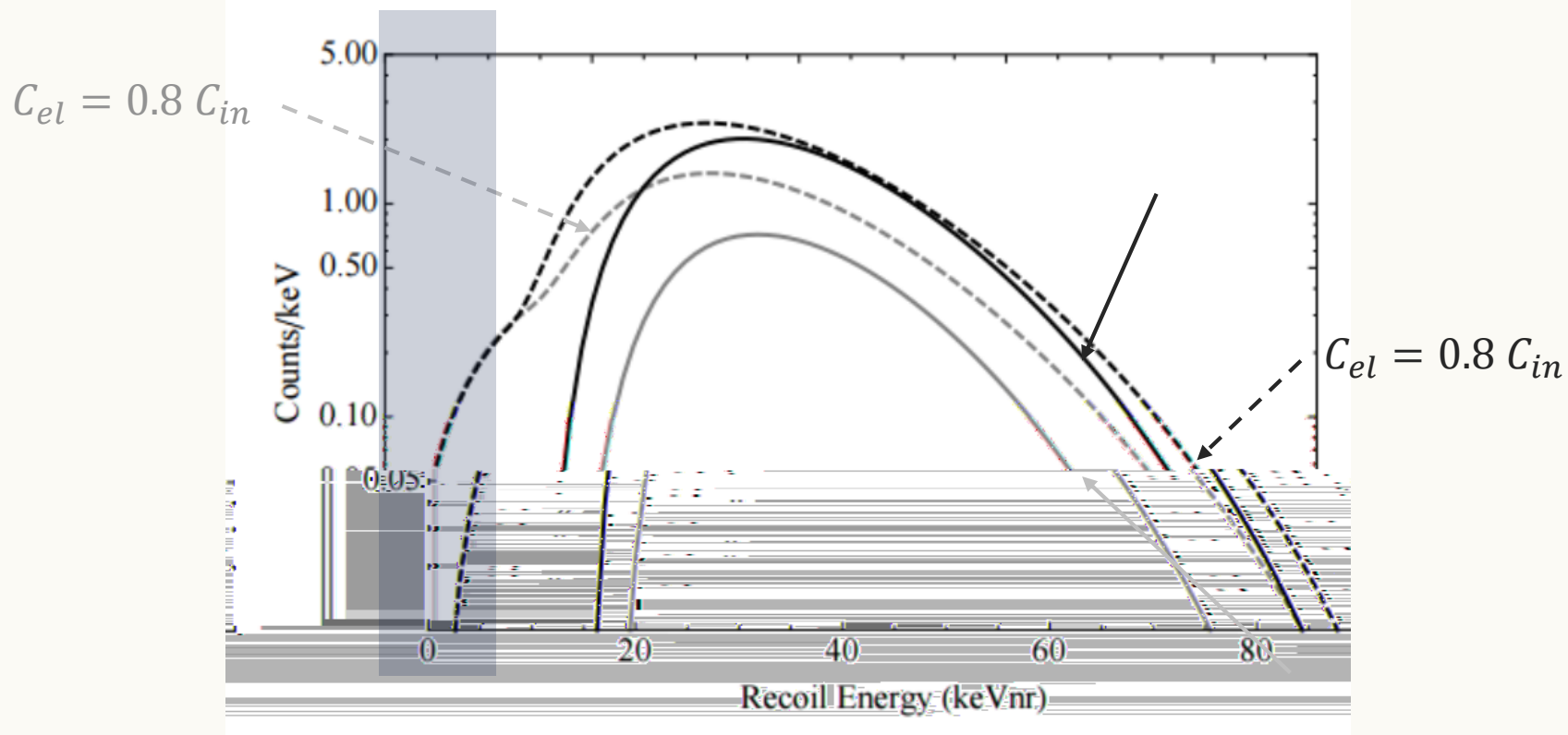
$$m_{dm} - \delta m$$



$$\chi^2(m_{dm}, \delta m, \sigma_p, v_0, v_{esc}, \alpha) = \chi_{min}^2 + \Delta\chi^2(CL), \quad (15)$$

$$(v_0, v_{esc}, \alpha) = (294, 501, 0.86) \quad (17)$$

$$(m_{dm}, \delta m, \sigma_p) = (74 \text{ GeV}, 98 \text{ keV}, 10^{-20} \text{ cm}^2/\text{s})$$



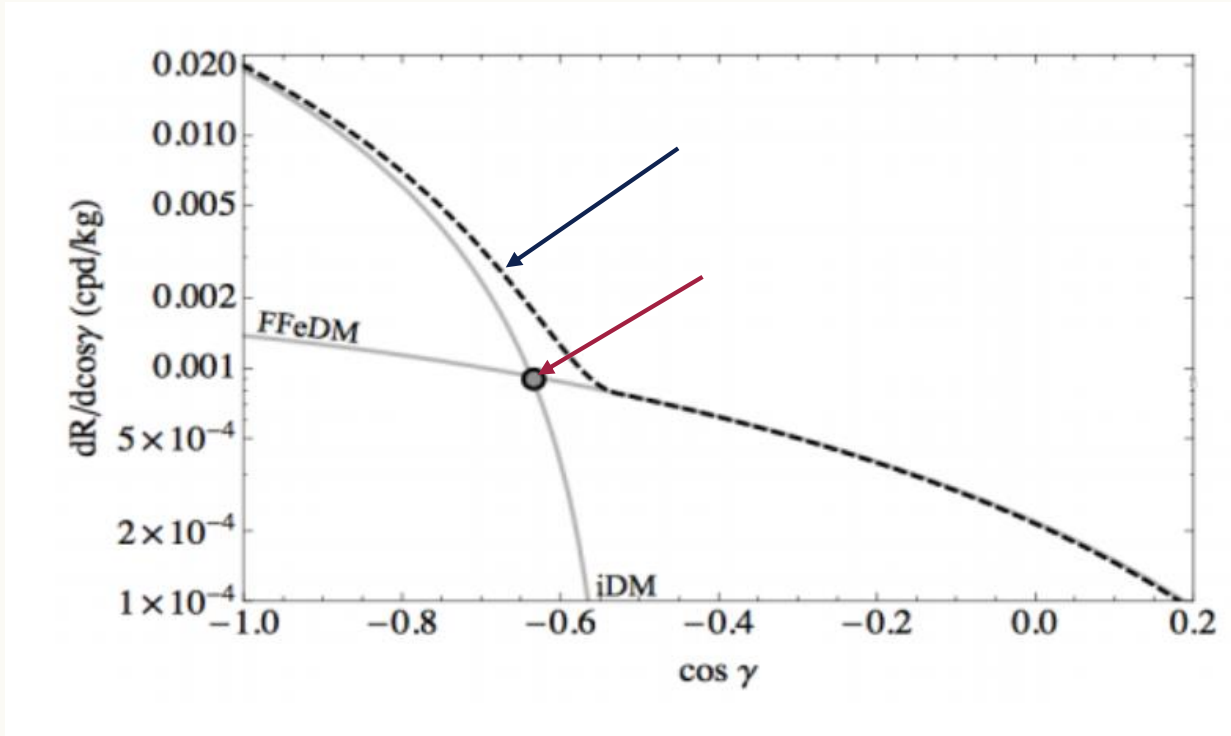
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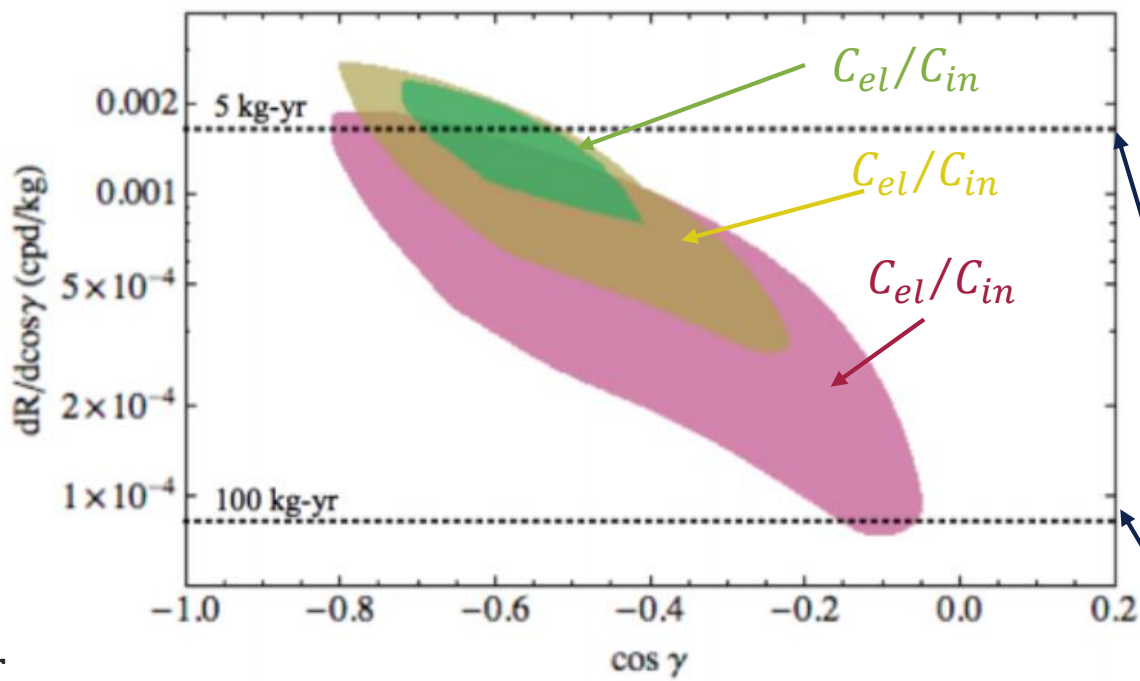
cos γ spectrum



summer

$$C_{el} = 0.8C_{in}$$
$$CF_3I$$

$$E_r = 50\text{keVnr}$$



summer
 CF_3I
 $E_r = 50 \text{ keVnr}$

CF_4

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SD 90% C.I. upper limits and allowed region

