What's the matter with Σm_ν?

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with Lloyd Knox
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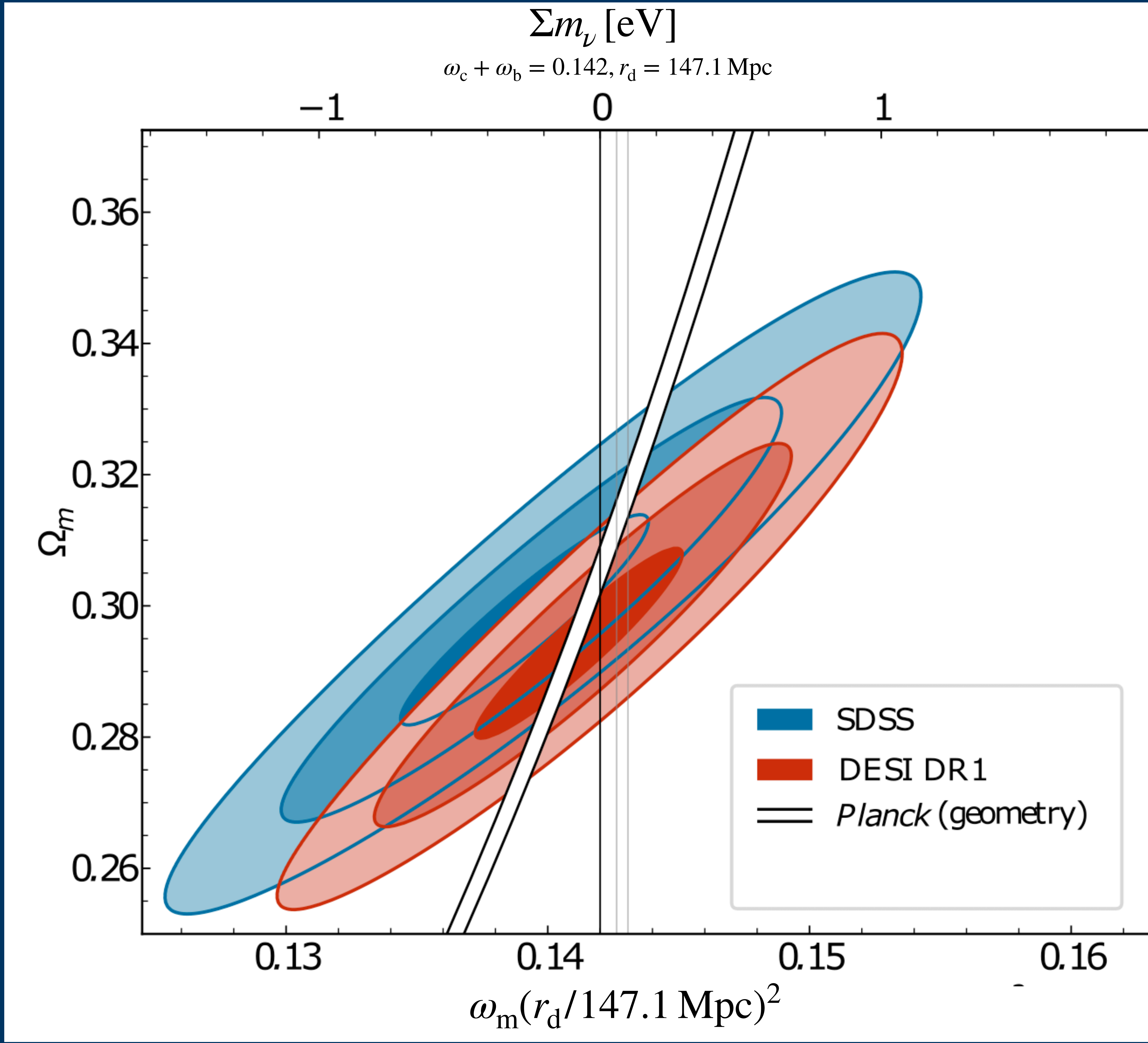

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Adapted from Loverde & Weiner 2410.00090

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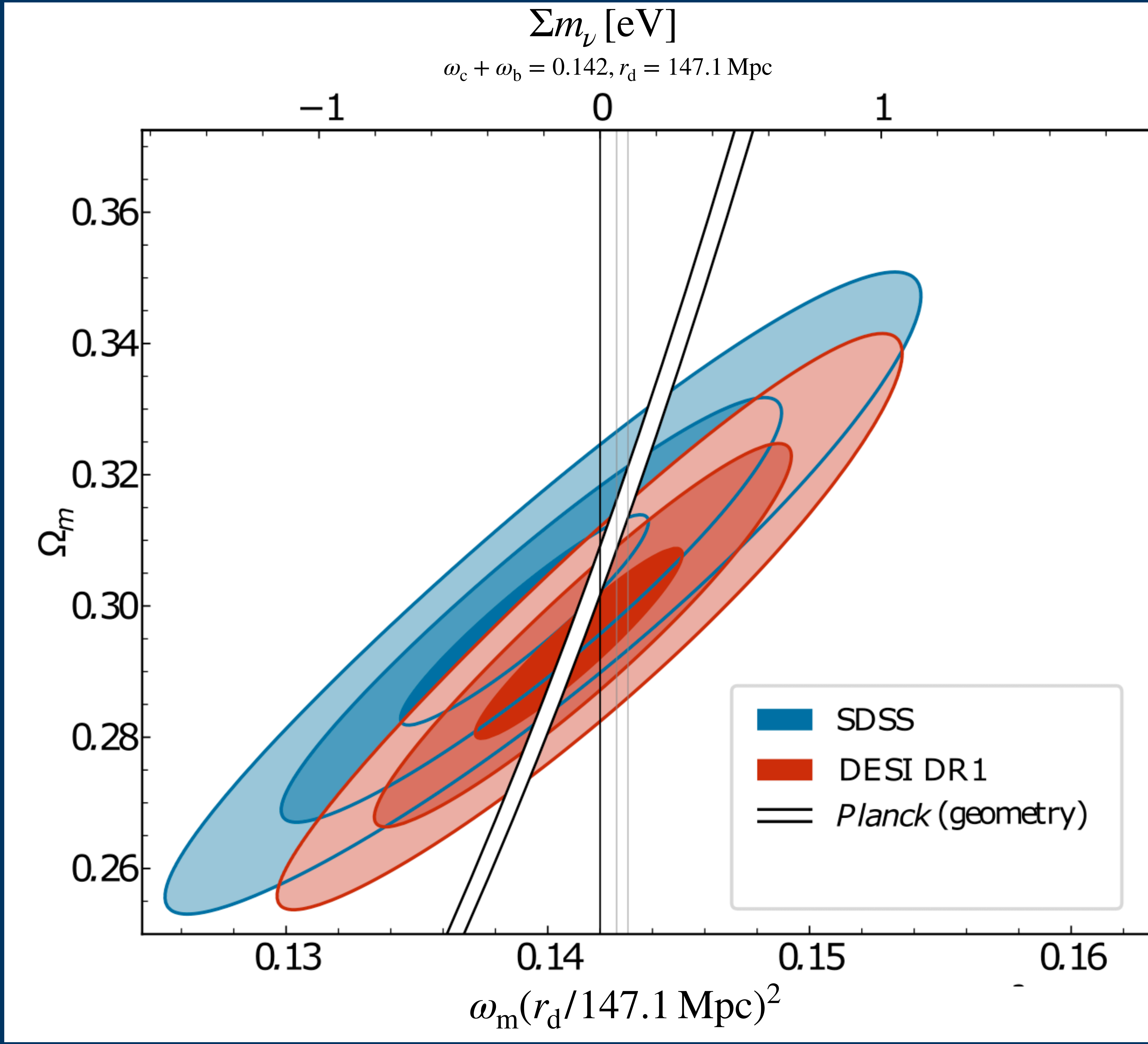

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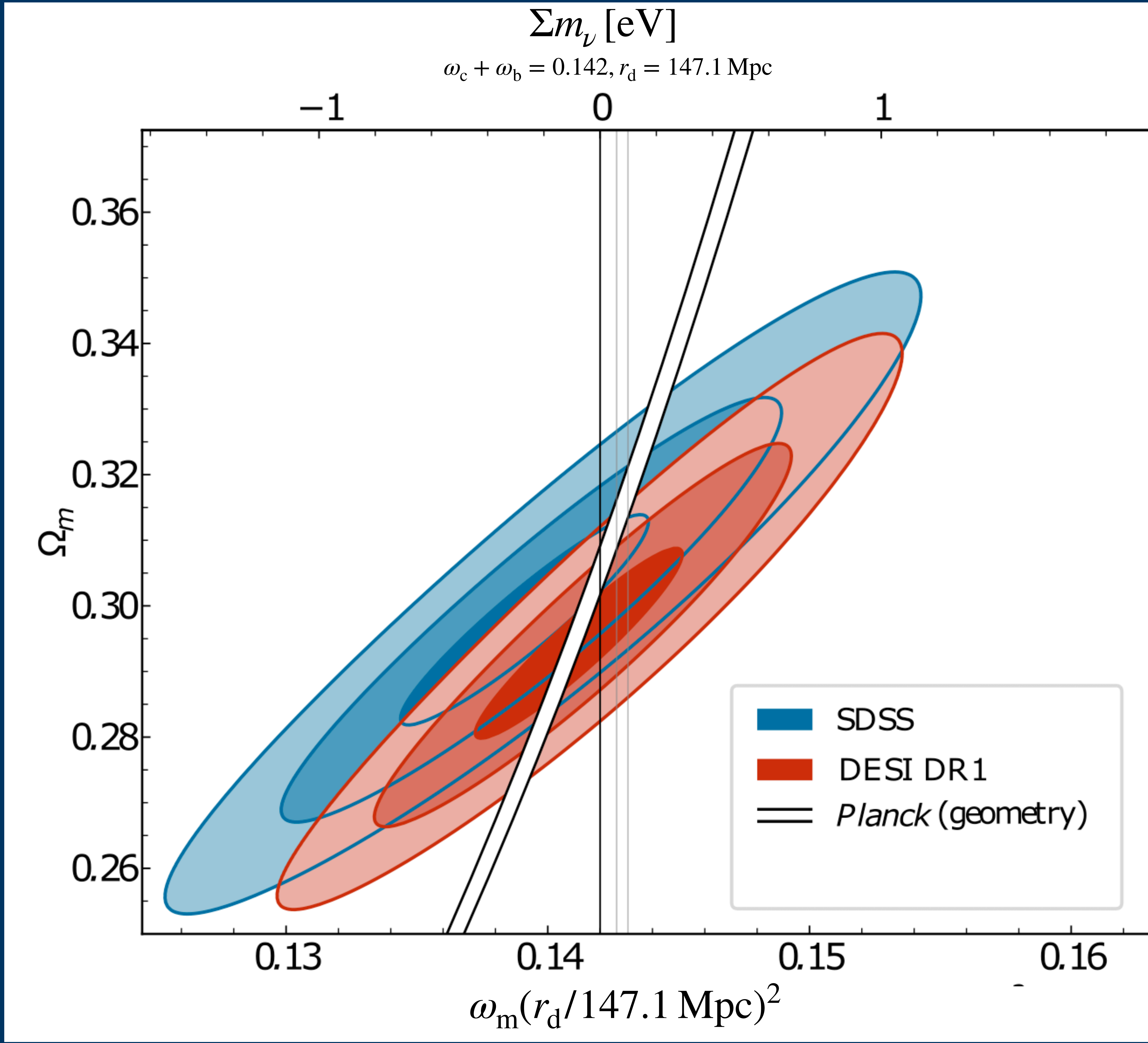

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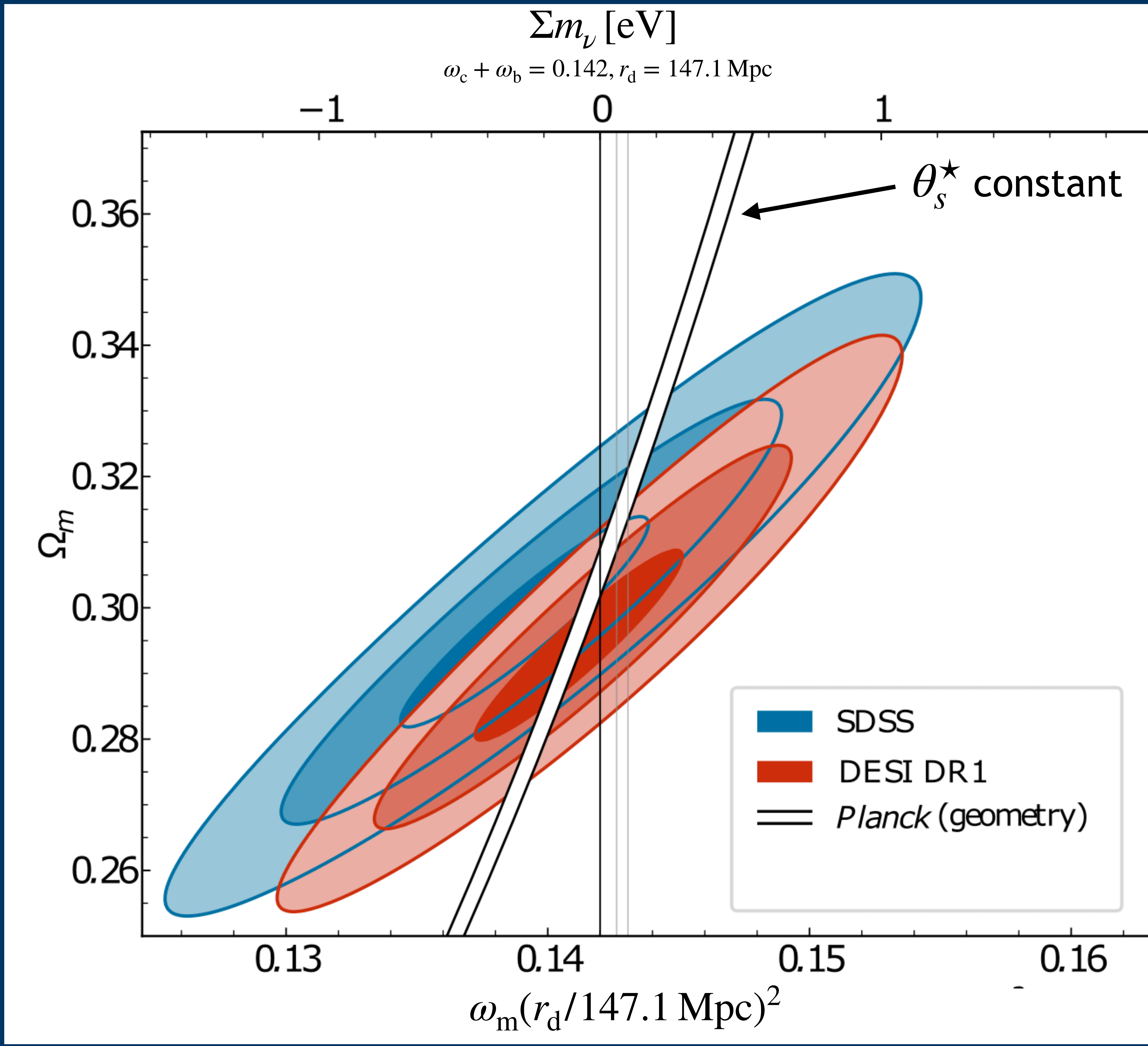

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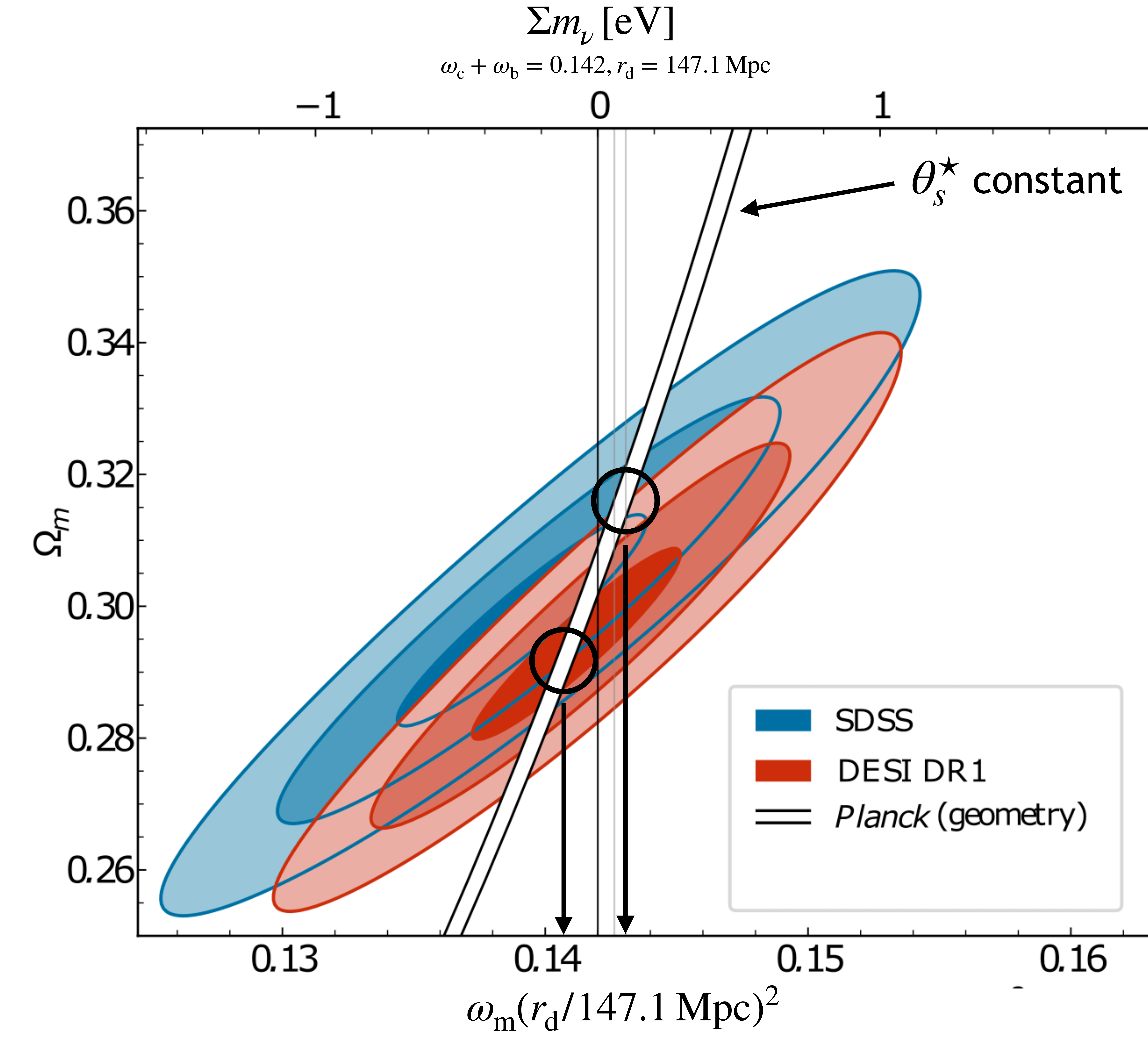

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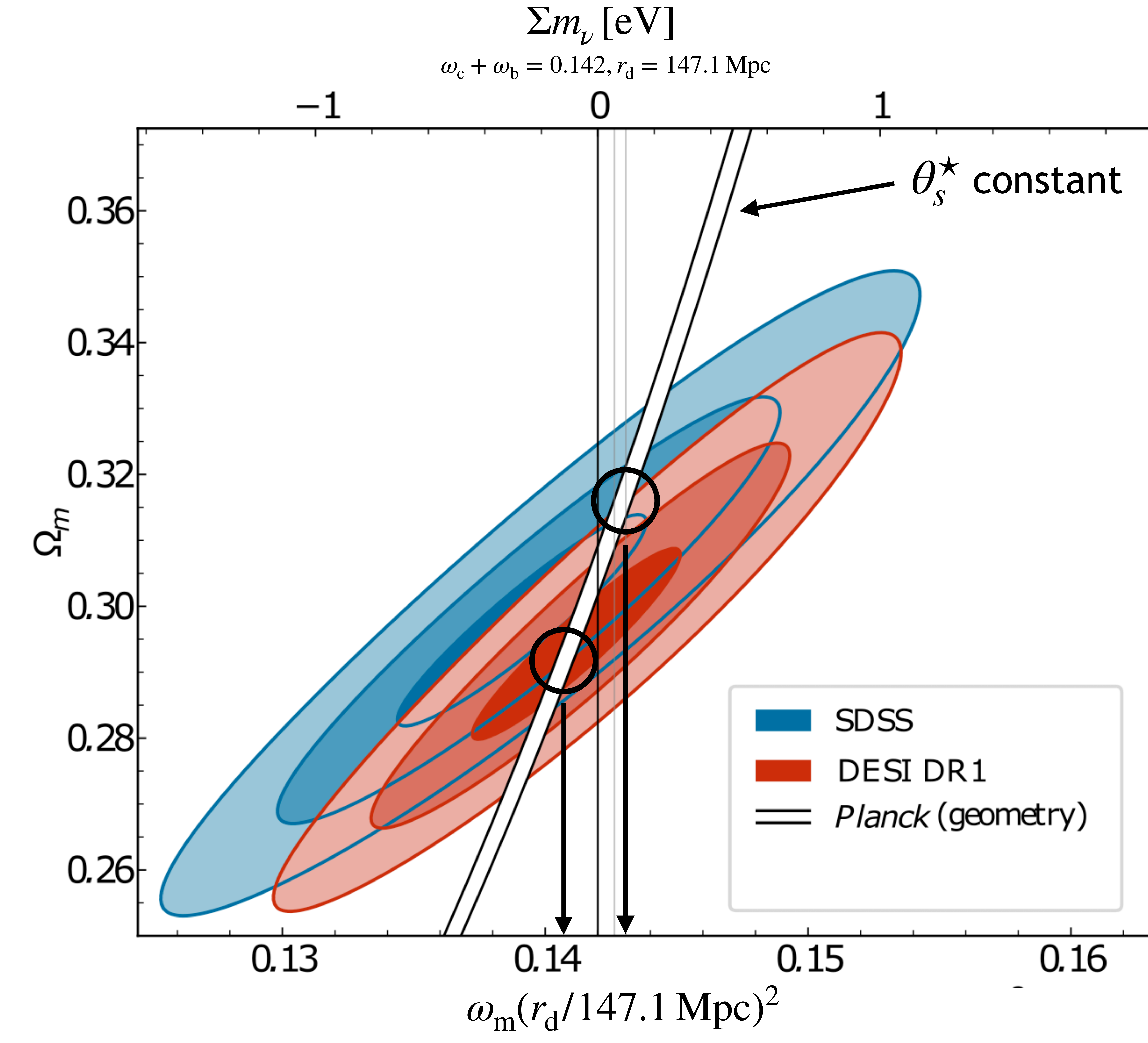
How significant is this?



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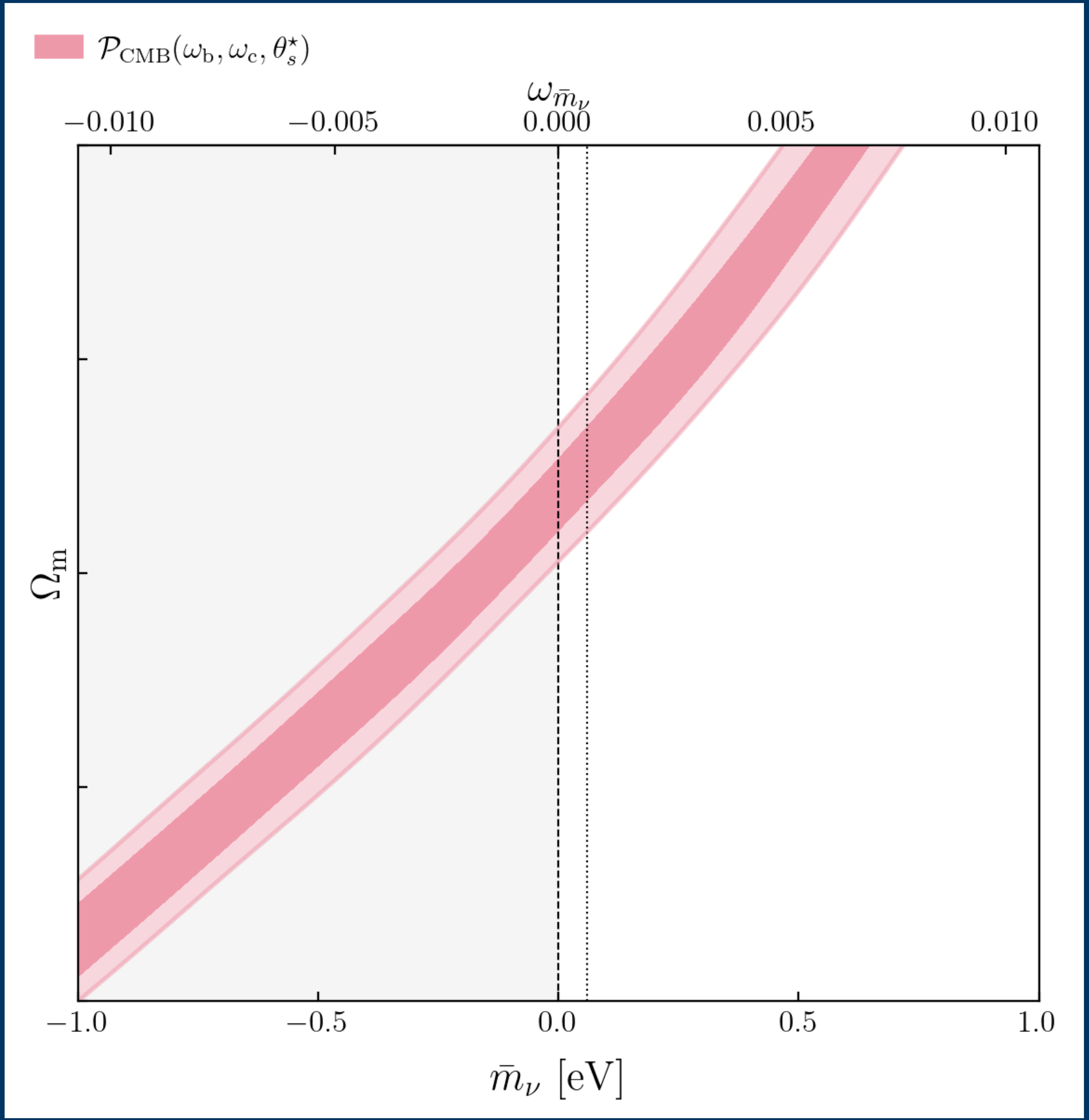
1. We phenomenologically extend impact of Σm_ν on background expansion to negative values



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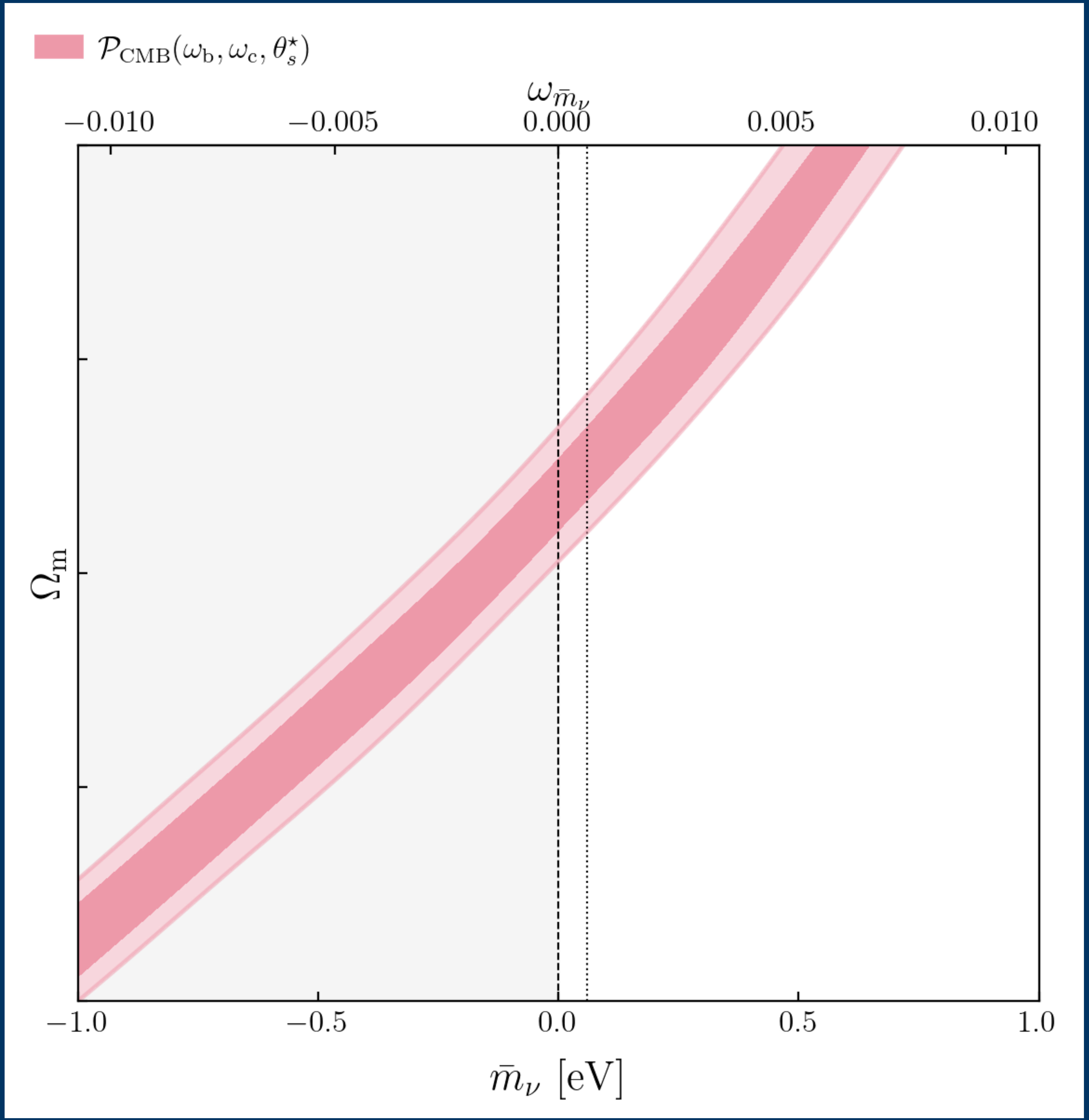

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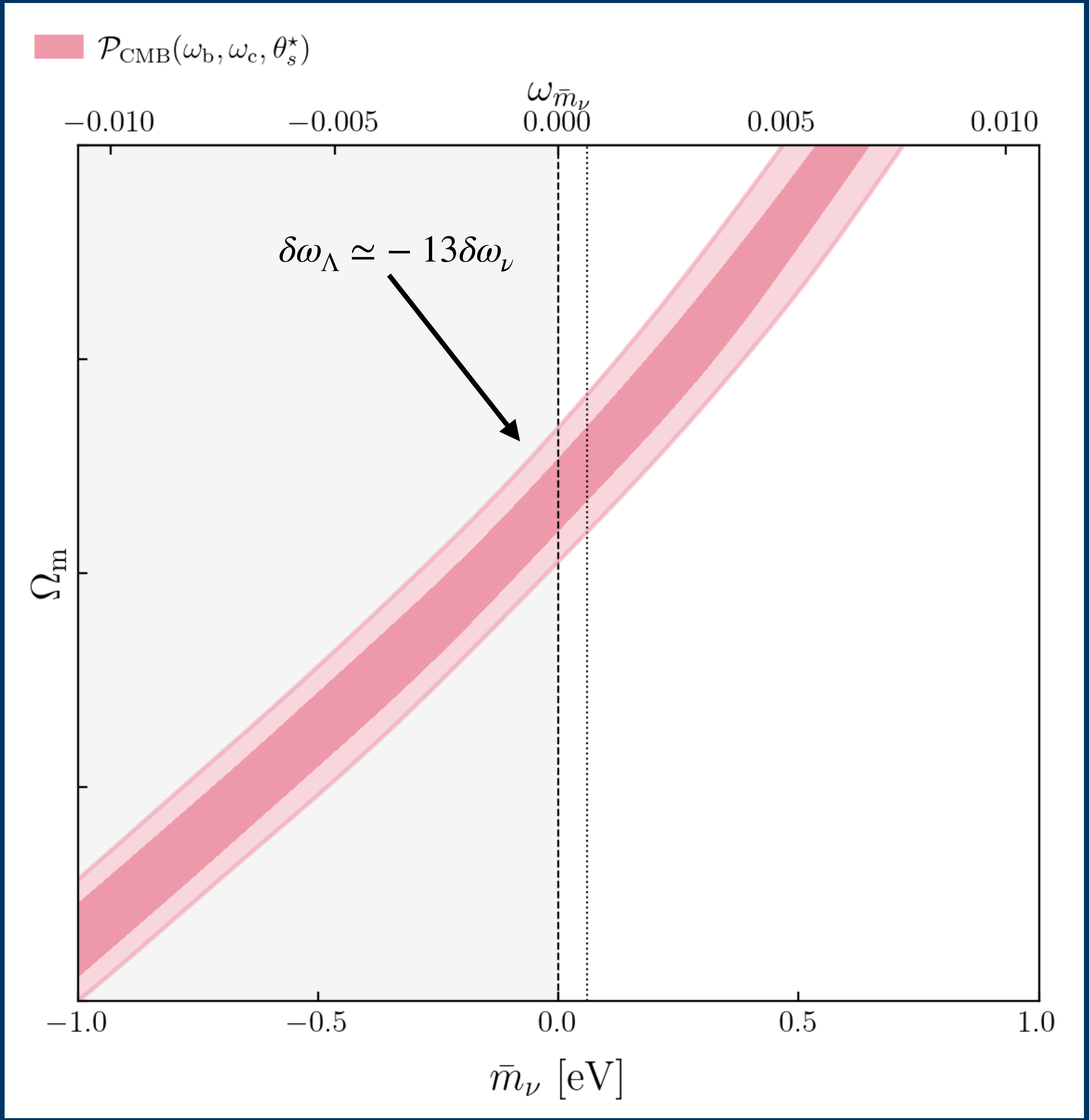

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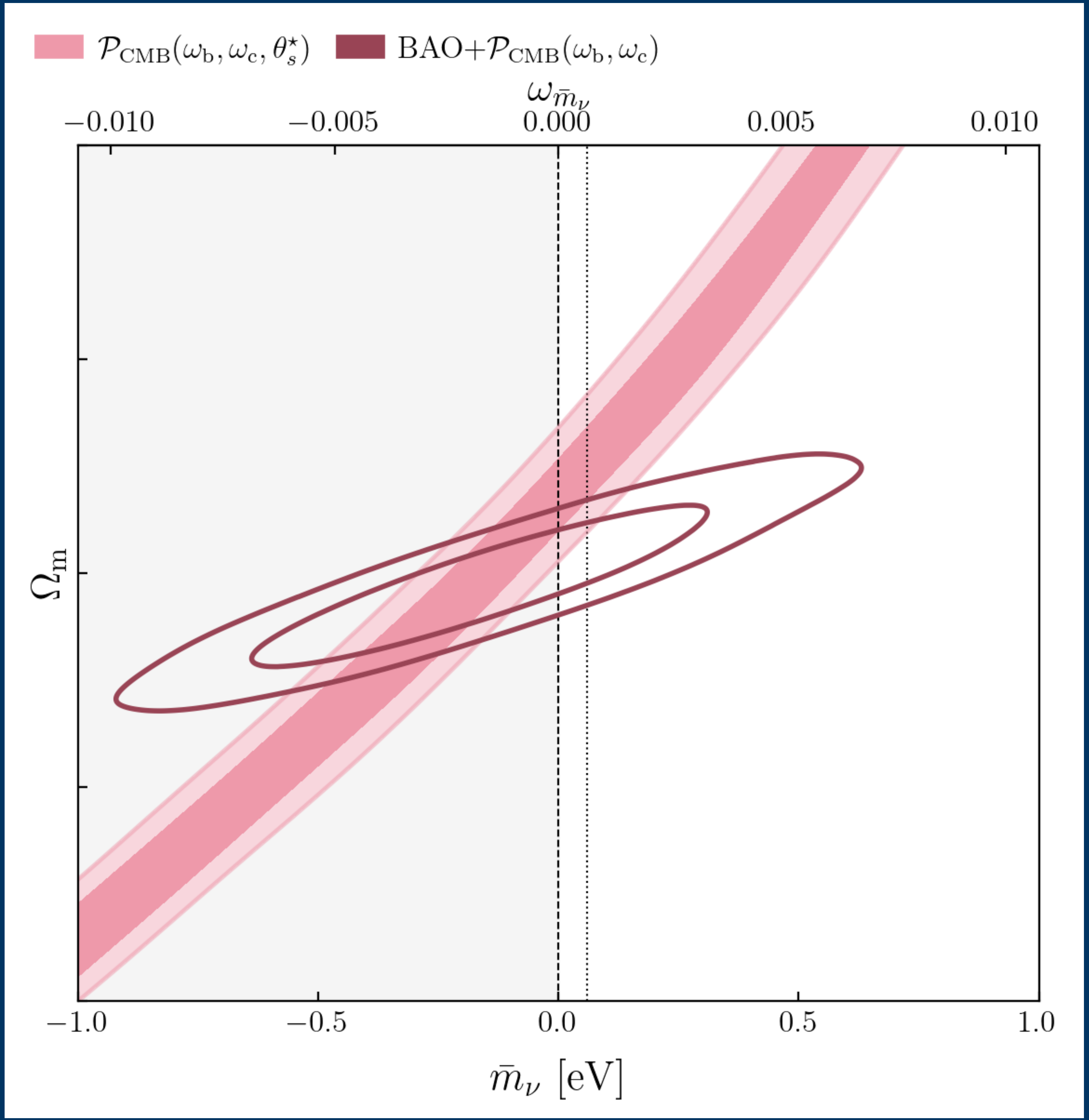

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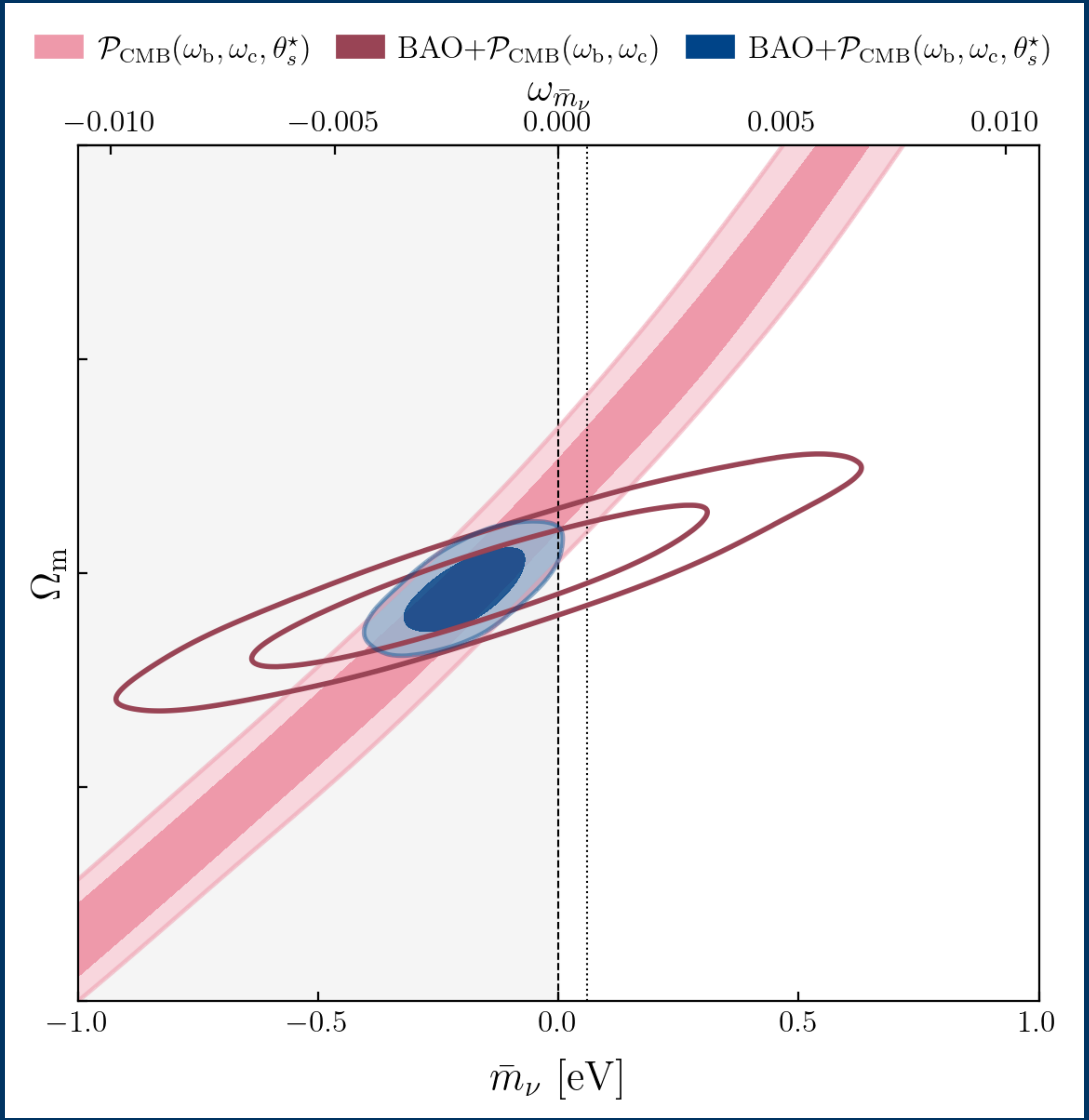

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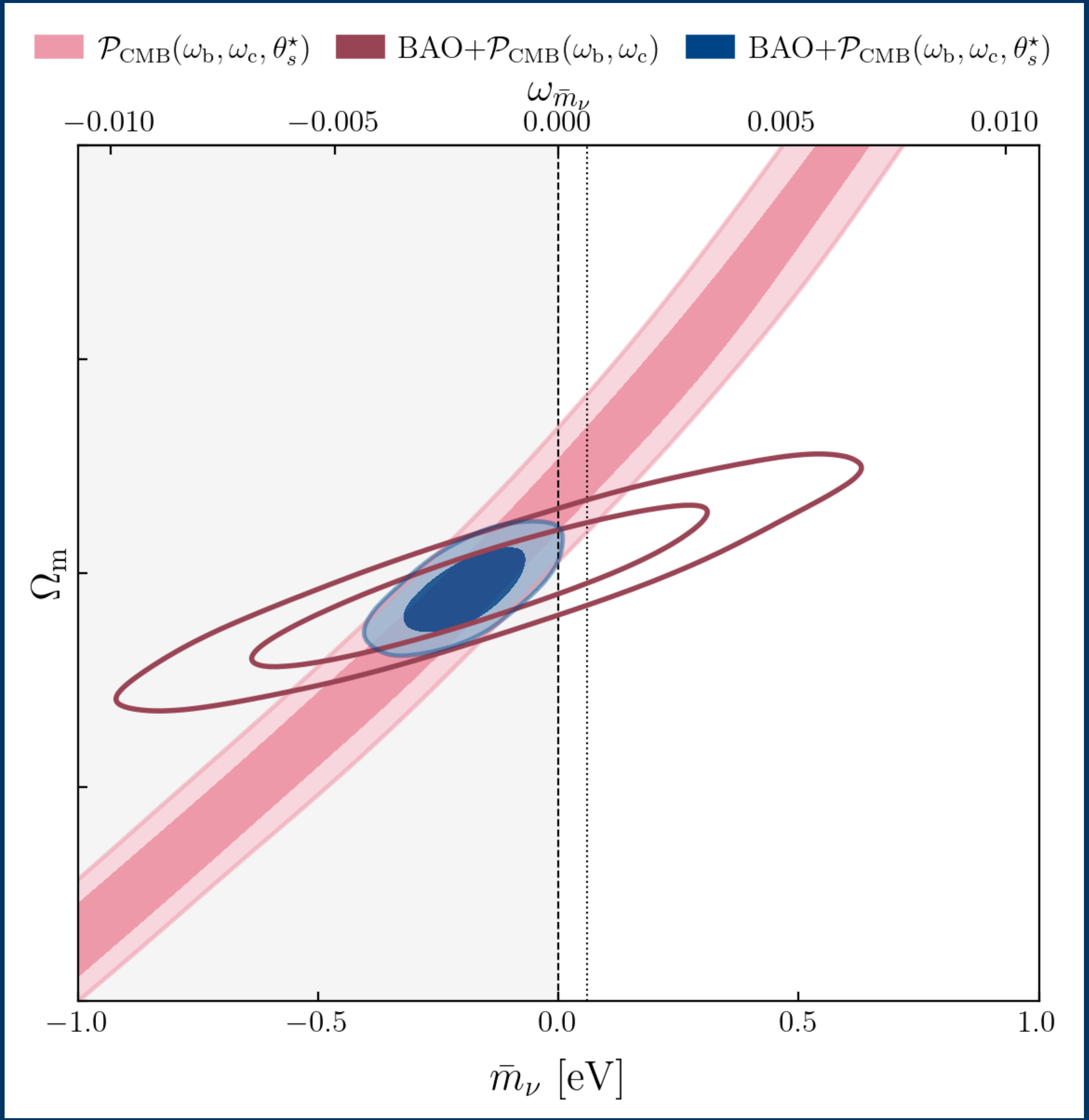
$$\bar{m}_\nu = -.193 \pm 0.083\,\mathrm{eV}$$
$$(\bar{m}_\nu = 0.06\,\mathrm{eV}\text{ excluded at }3.0\,\sigma)$$



Relation to lensing excess?

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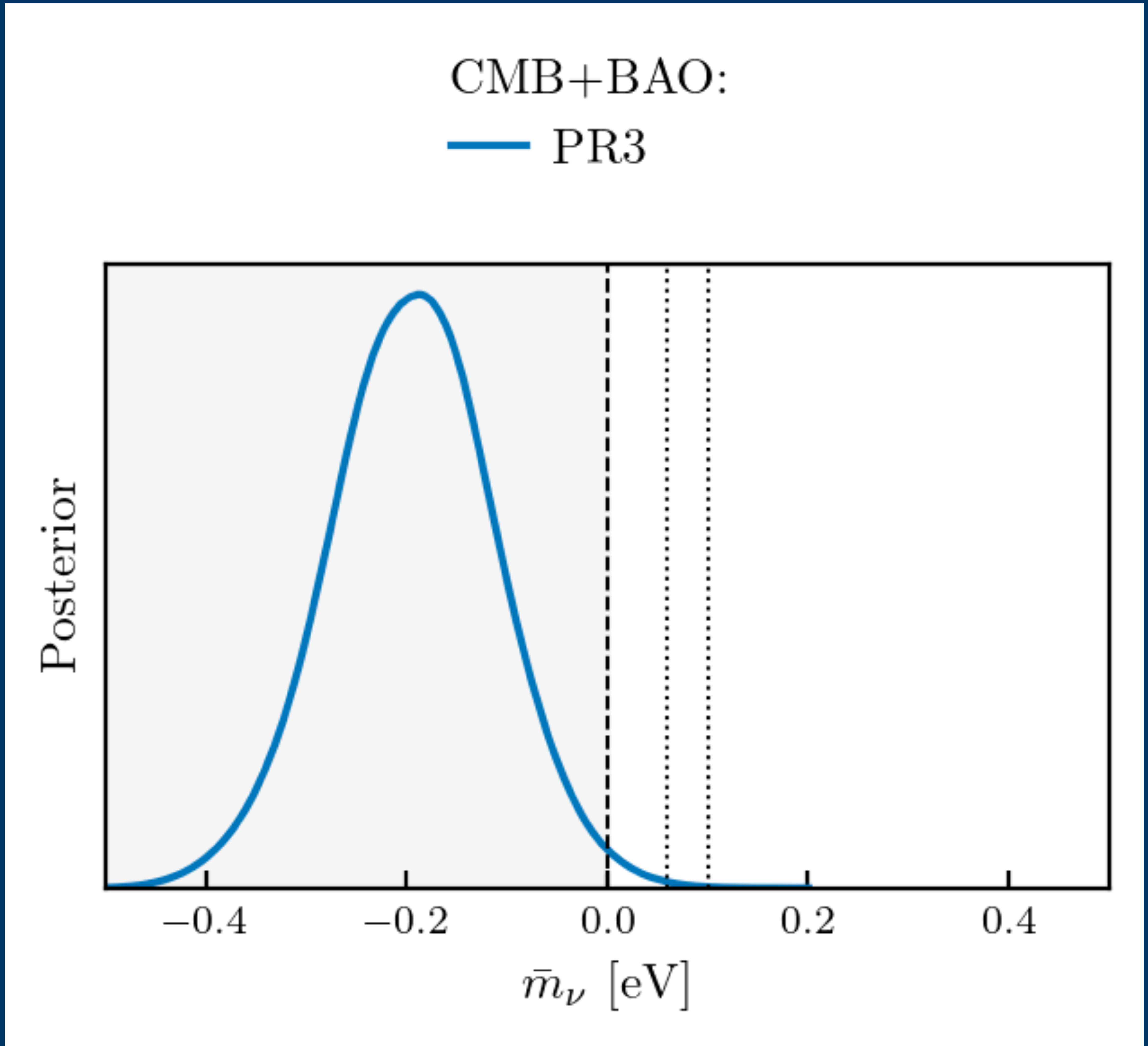

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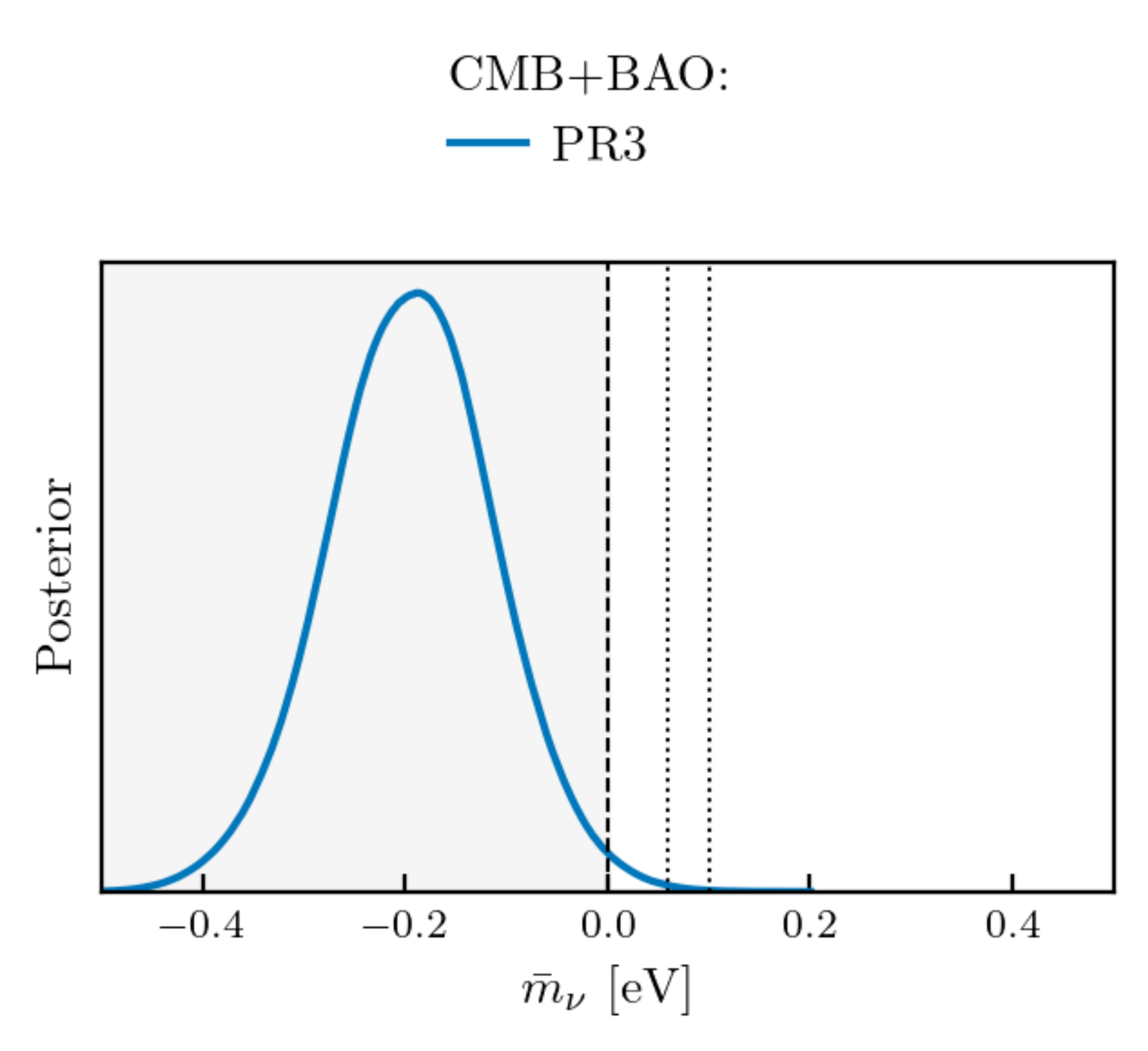

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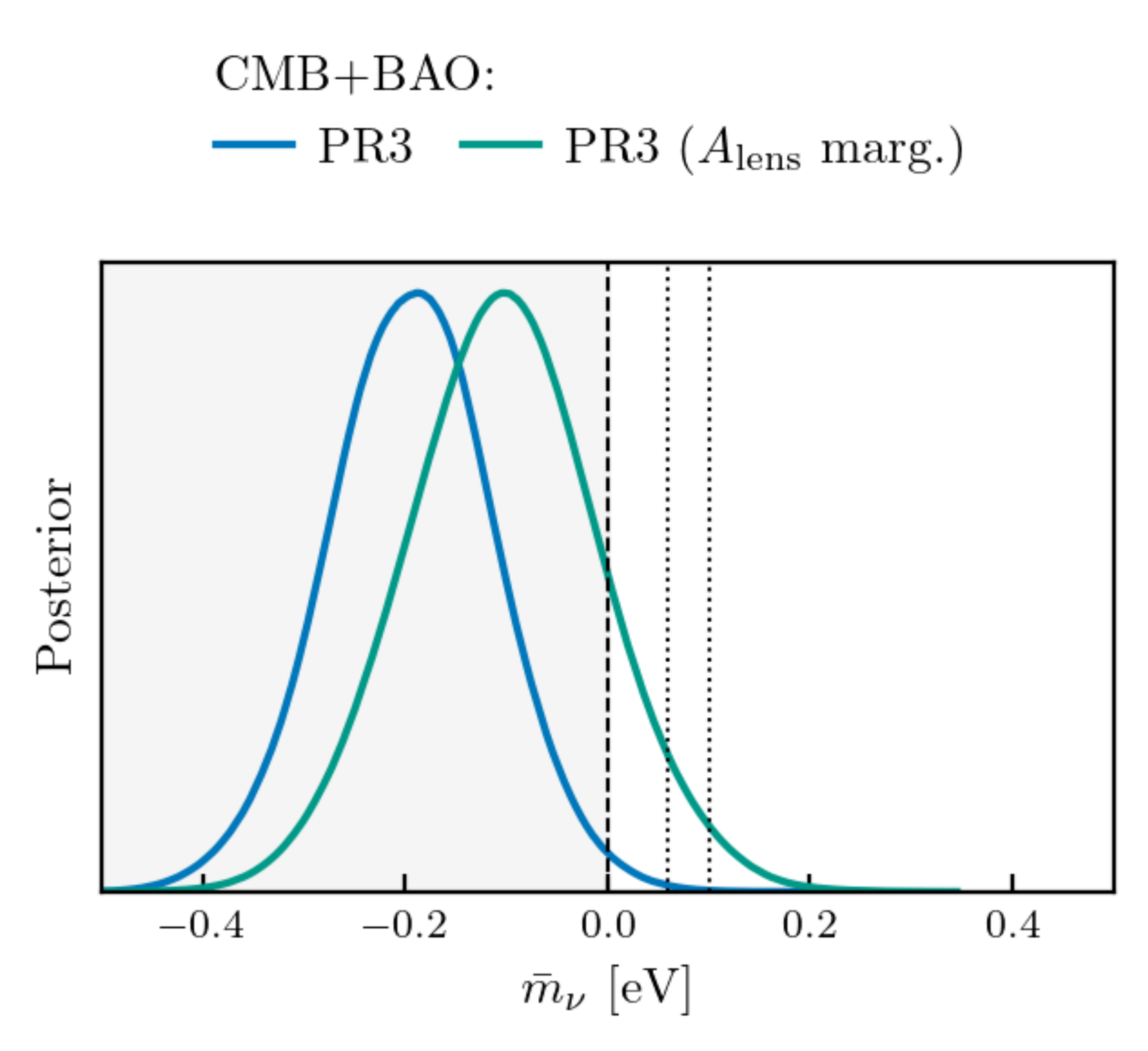

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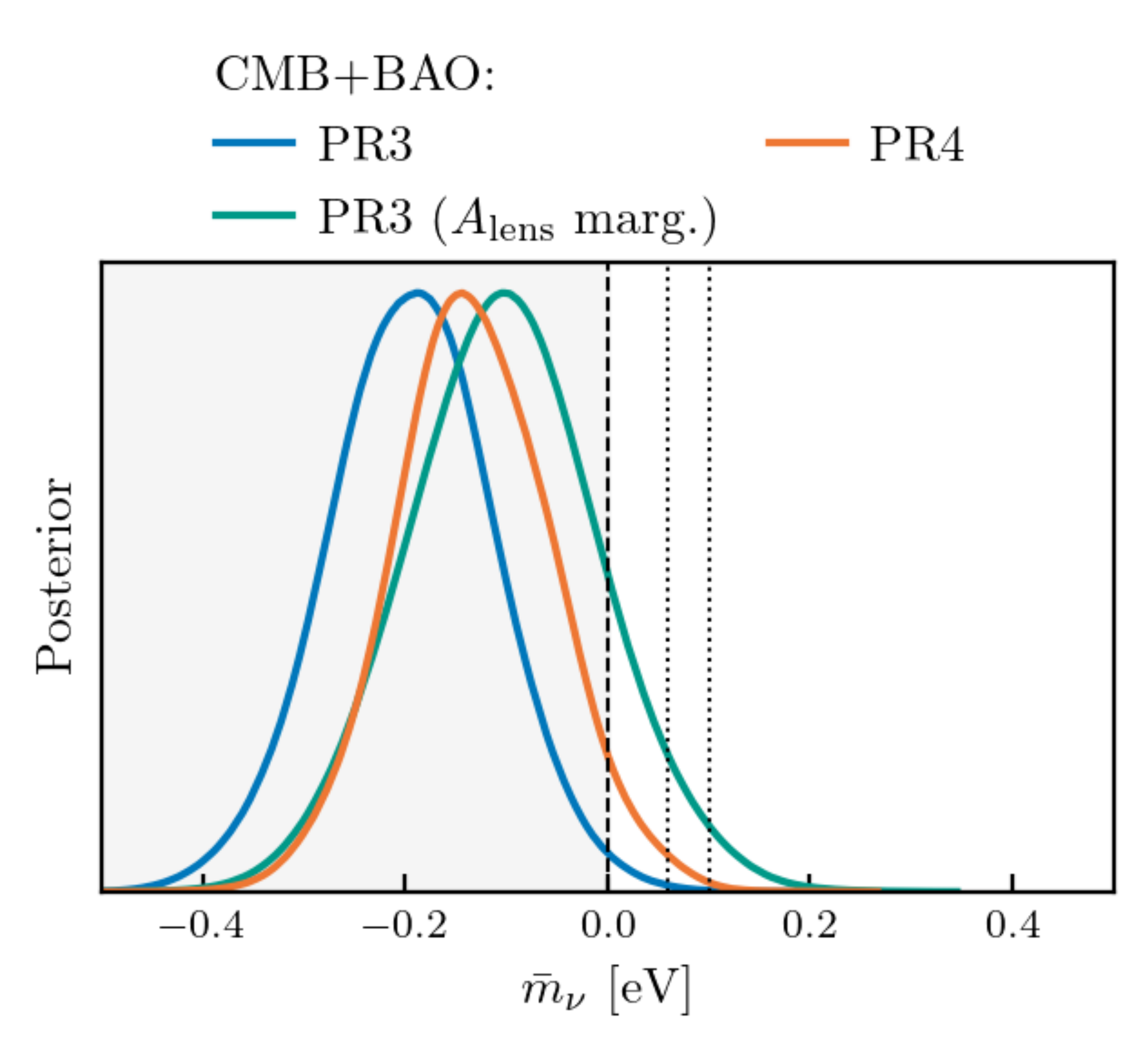

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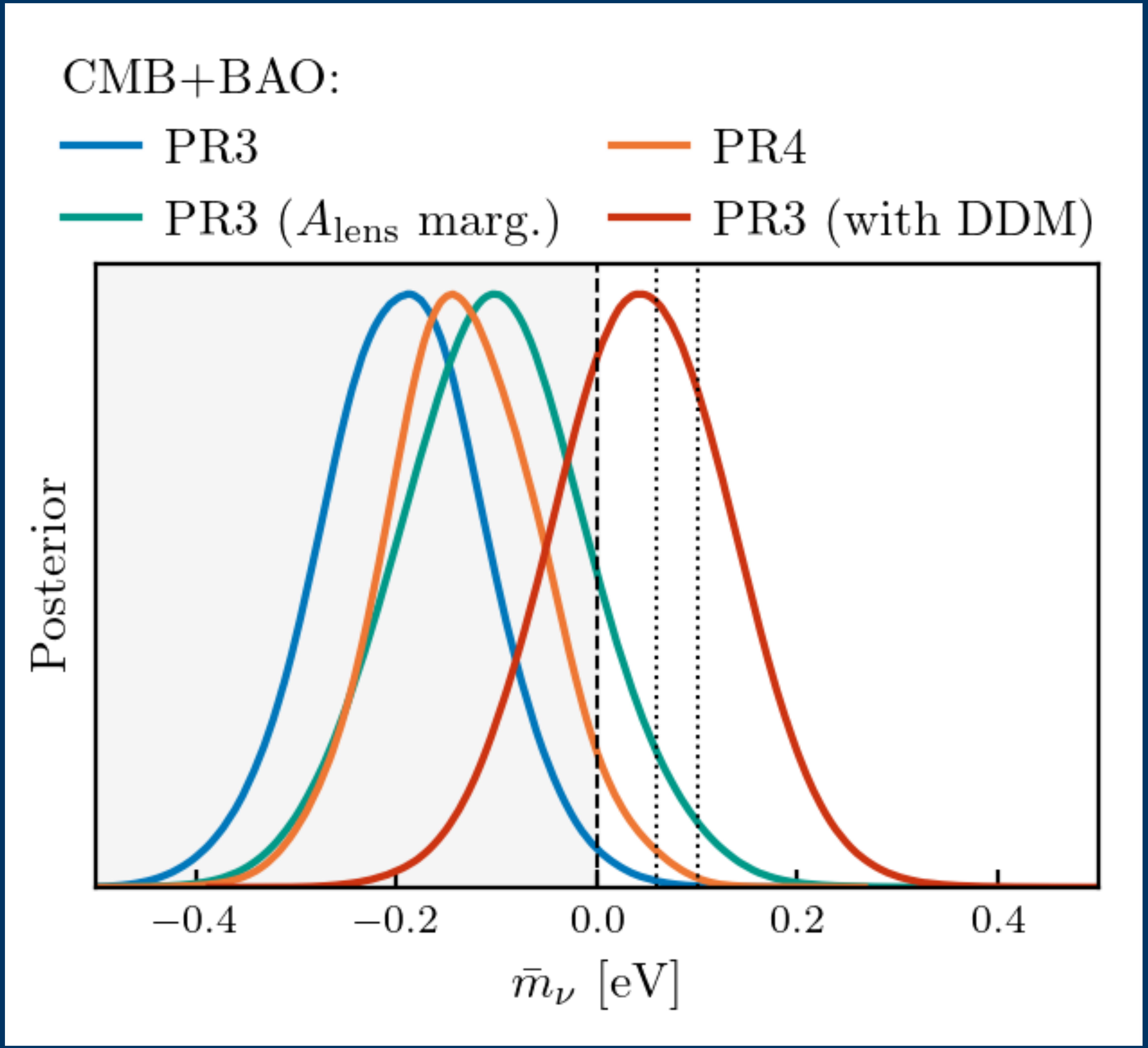
3. Some amount of decaying dark matter can restore $\omega_{\rm m} > \omega_{\rm cb}$, but makes lensing excess worse

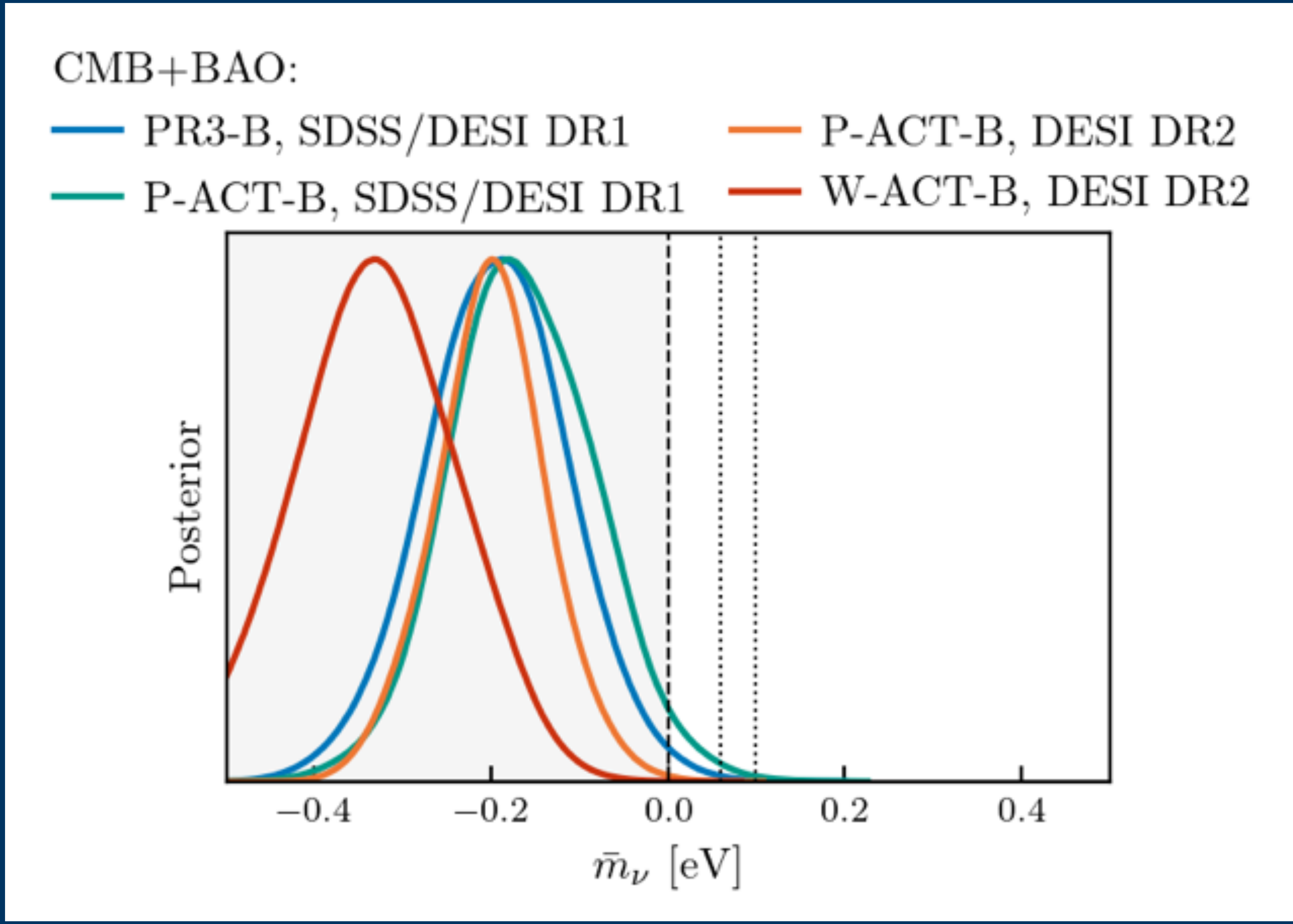


Impact of recent data

1. ACT DR6 and DESI DR2 do not change the qualitative picture

2. With Planck+ACT DR6+DESI DR2, 0.06 eV is now excluded at $4.1\,\sigma$

3. WMAP+ACT DR6+DESI DR2 (independent of Planck) infers a high ω_c, greatly exacerbating the deficit



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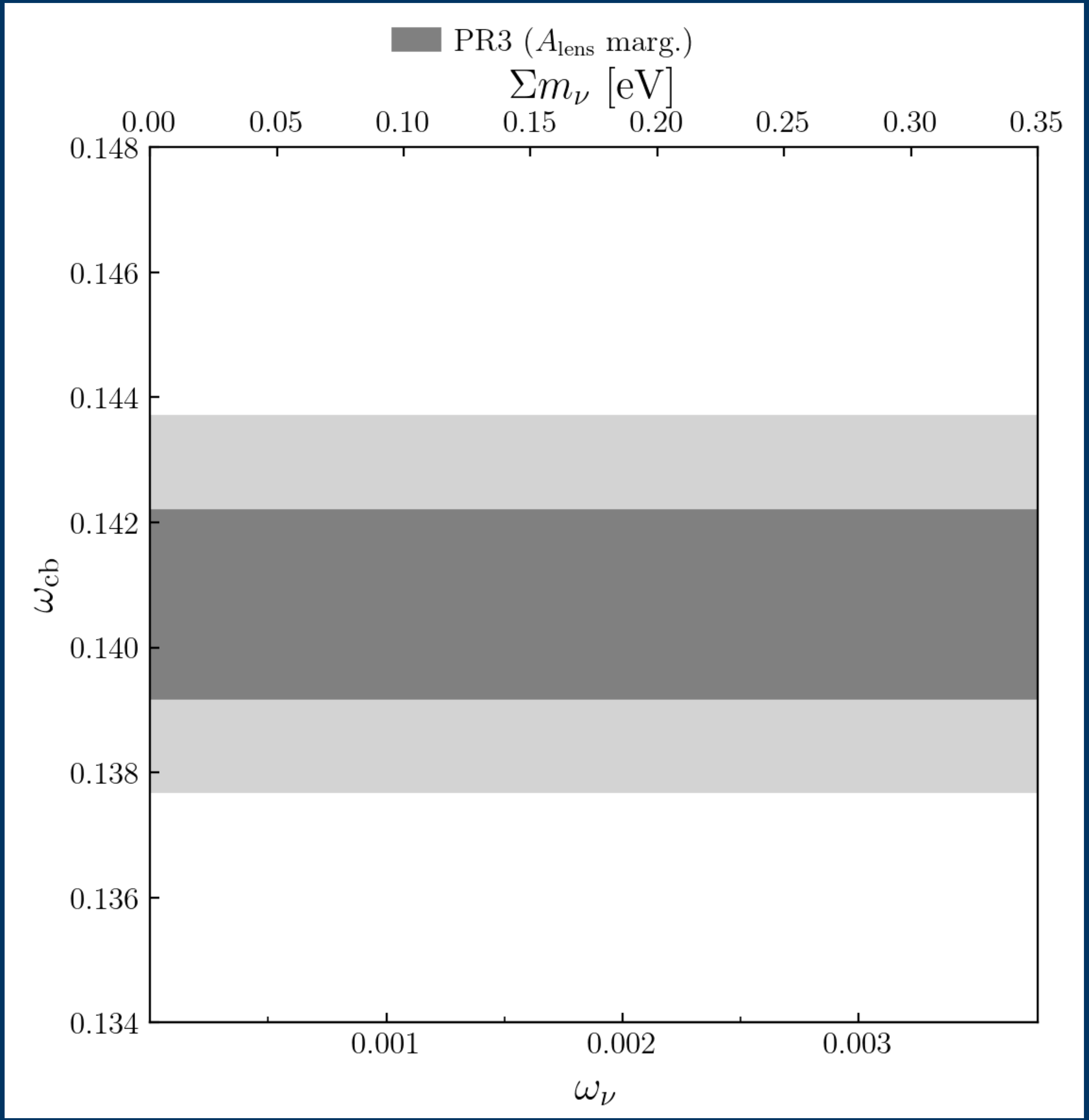

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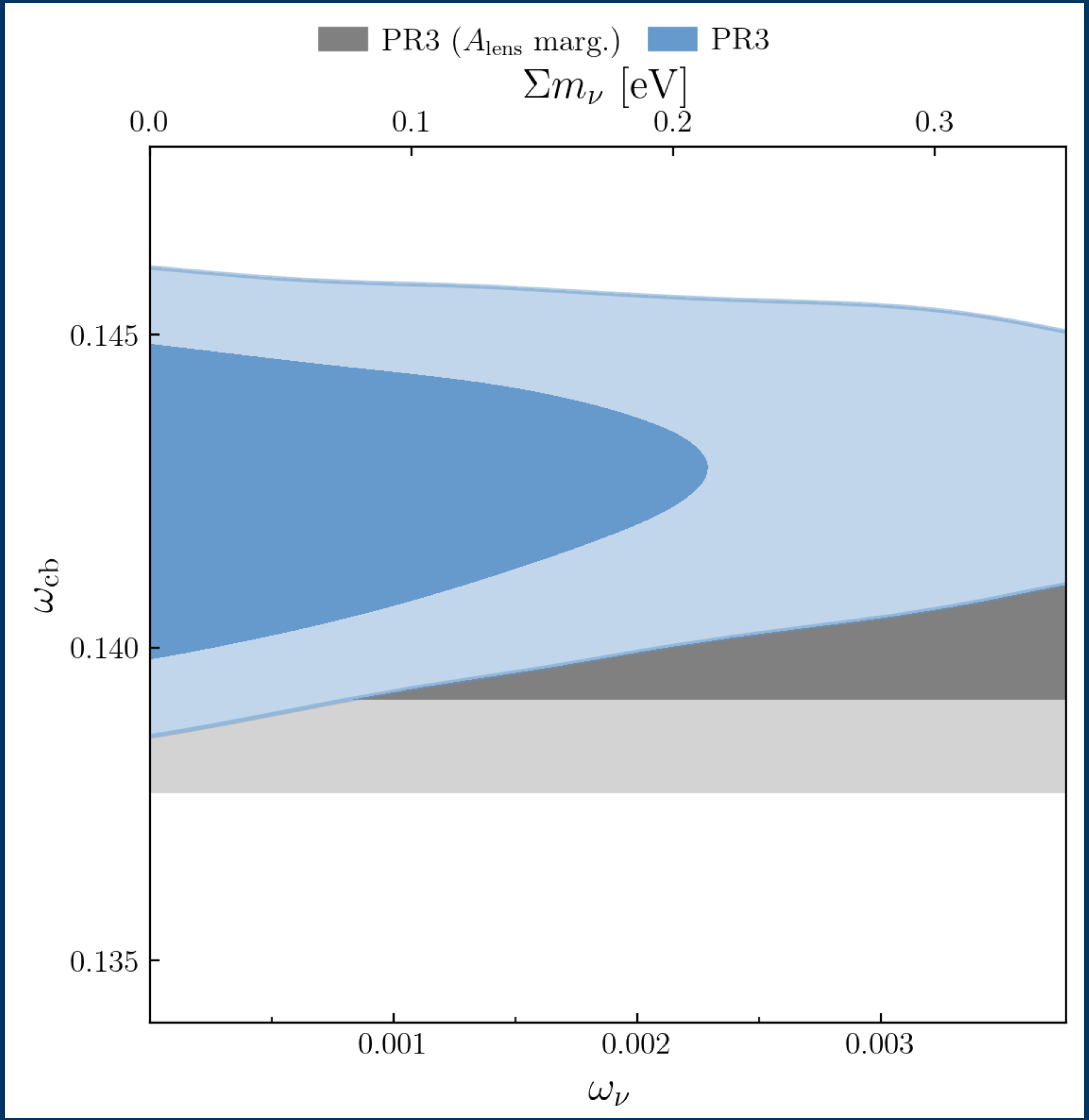

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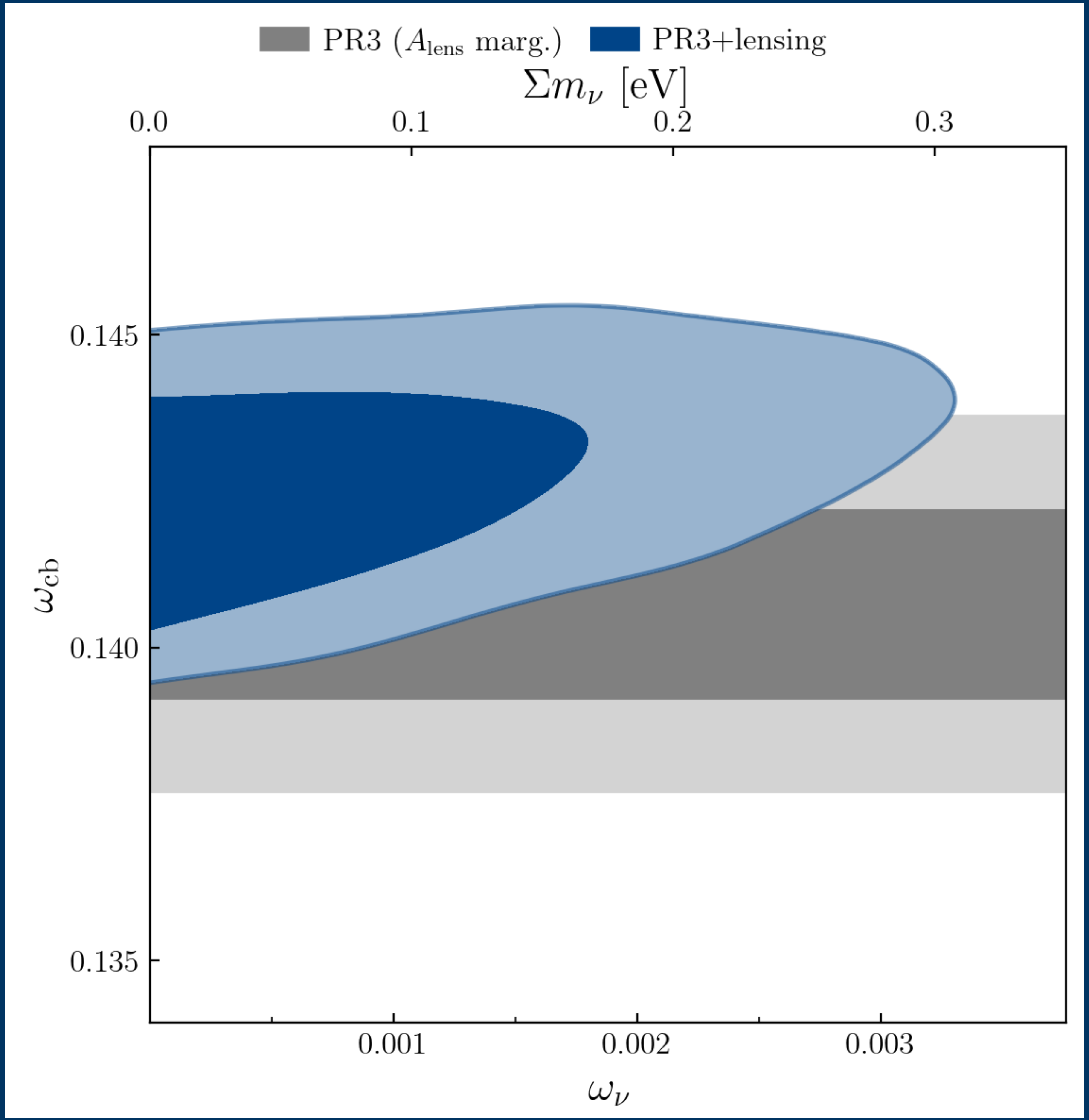

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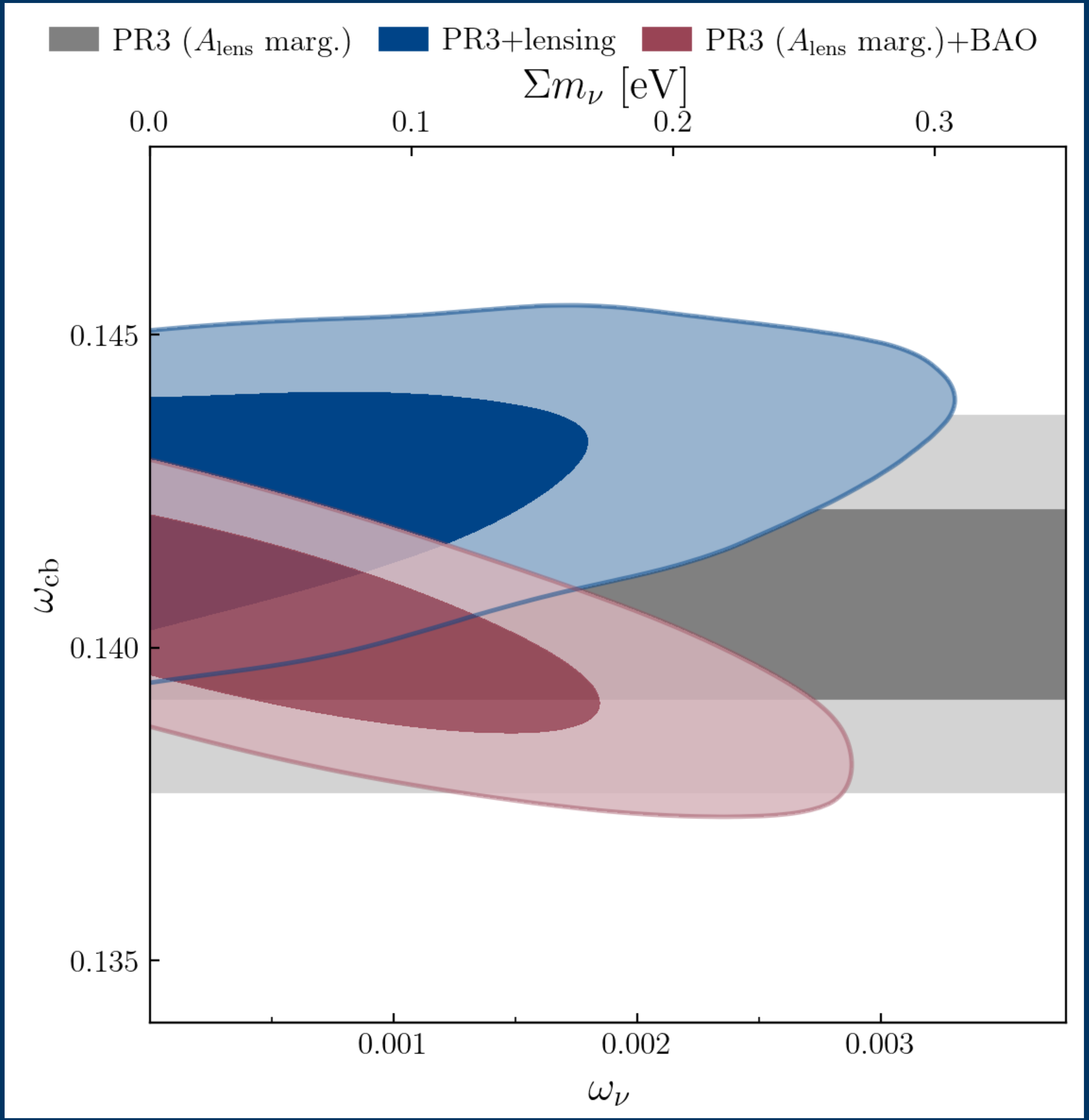

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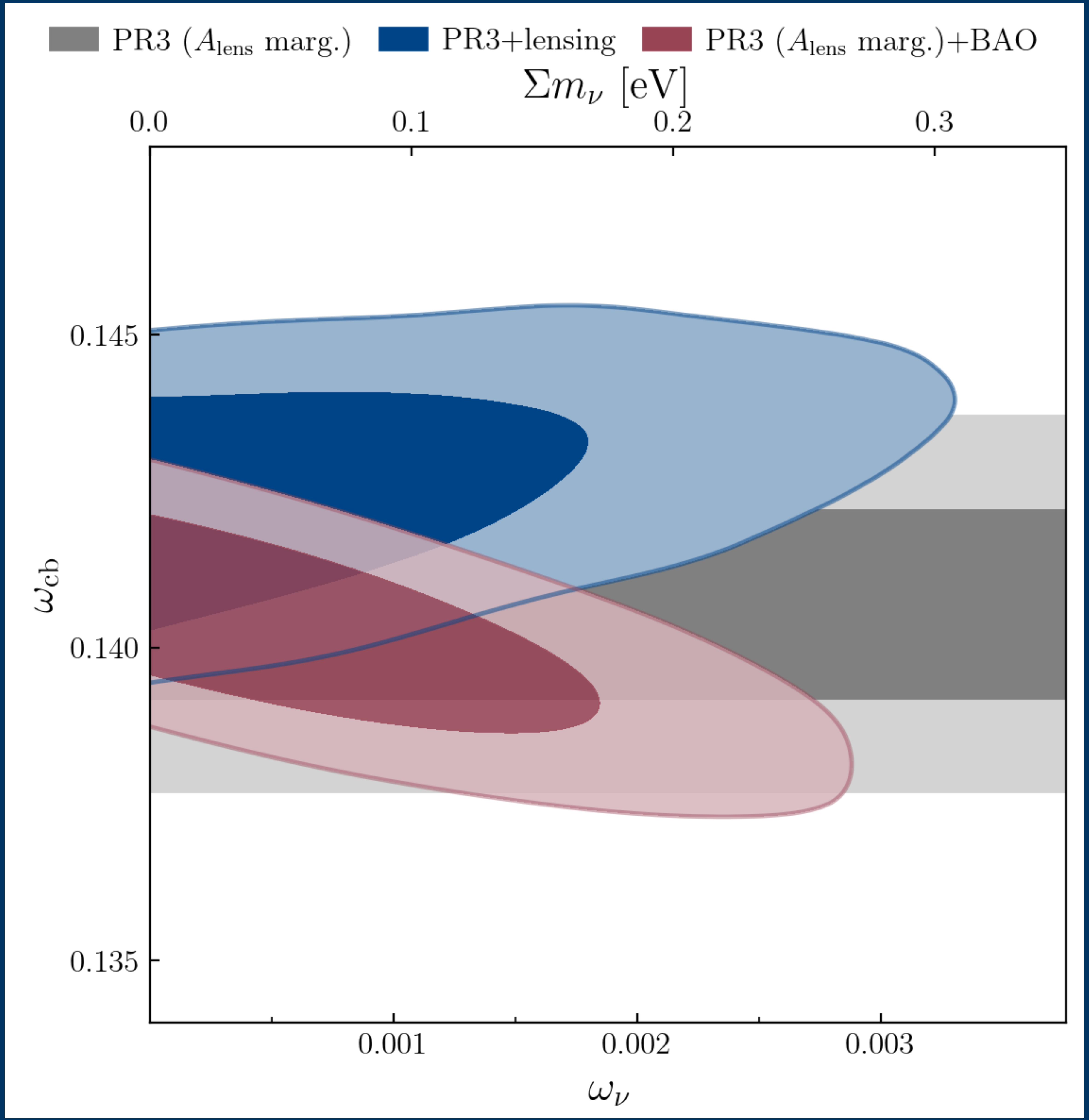

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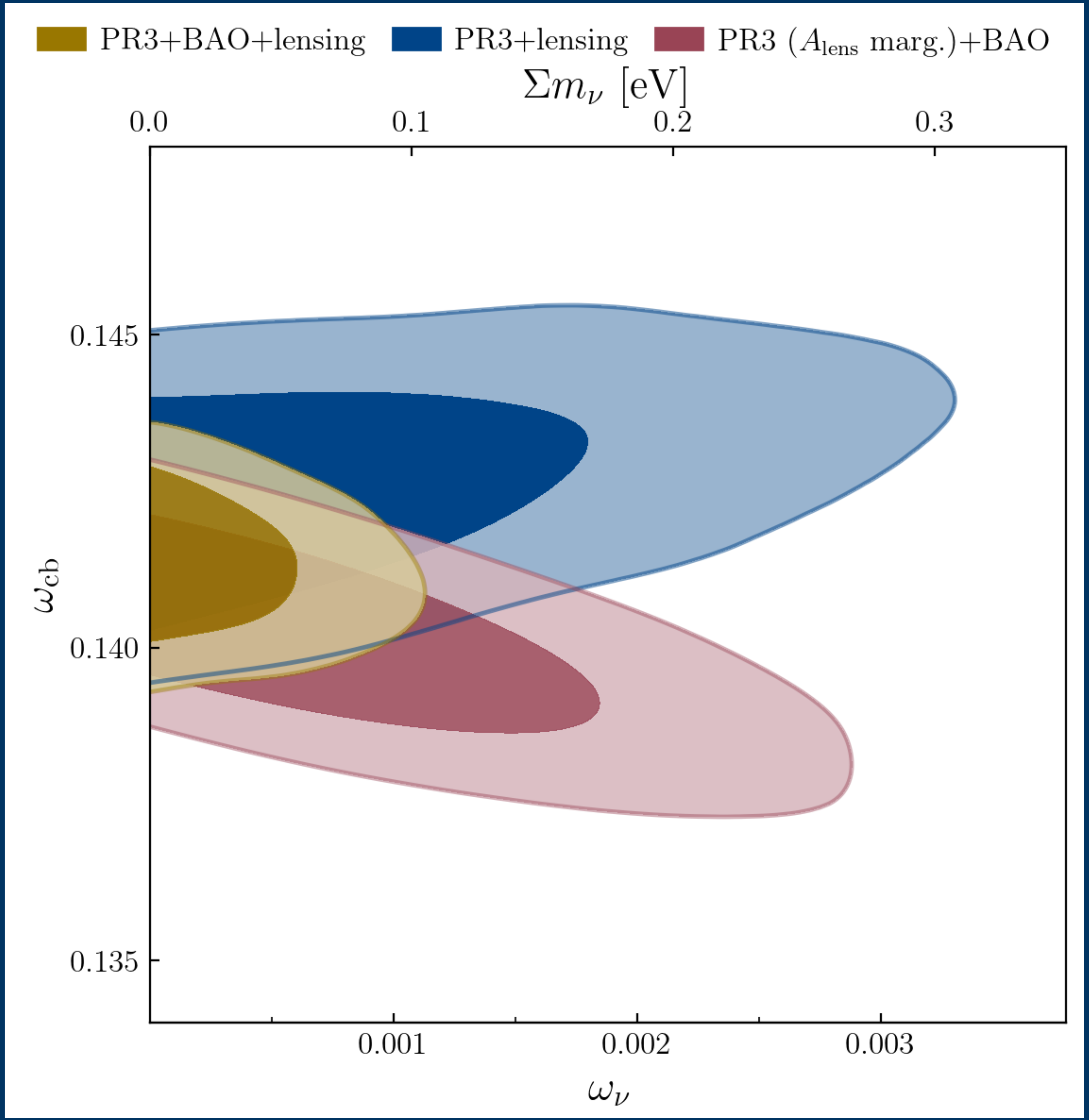

Conclusions

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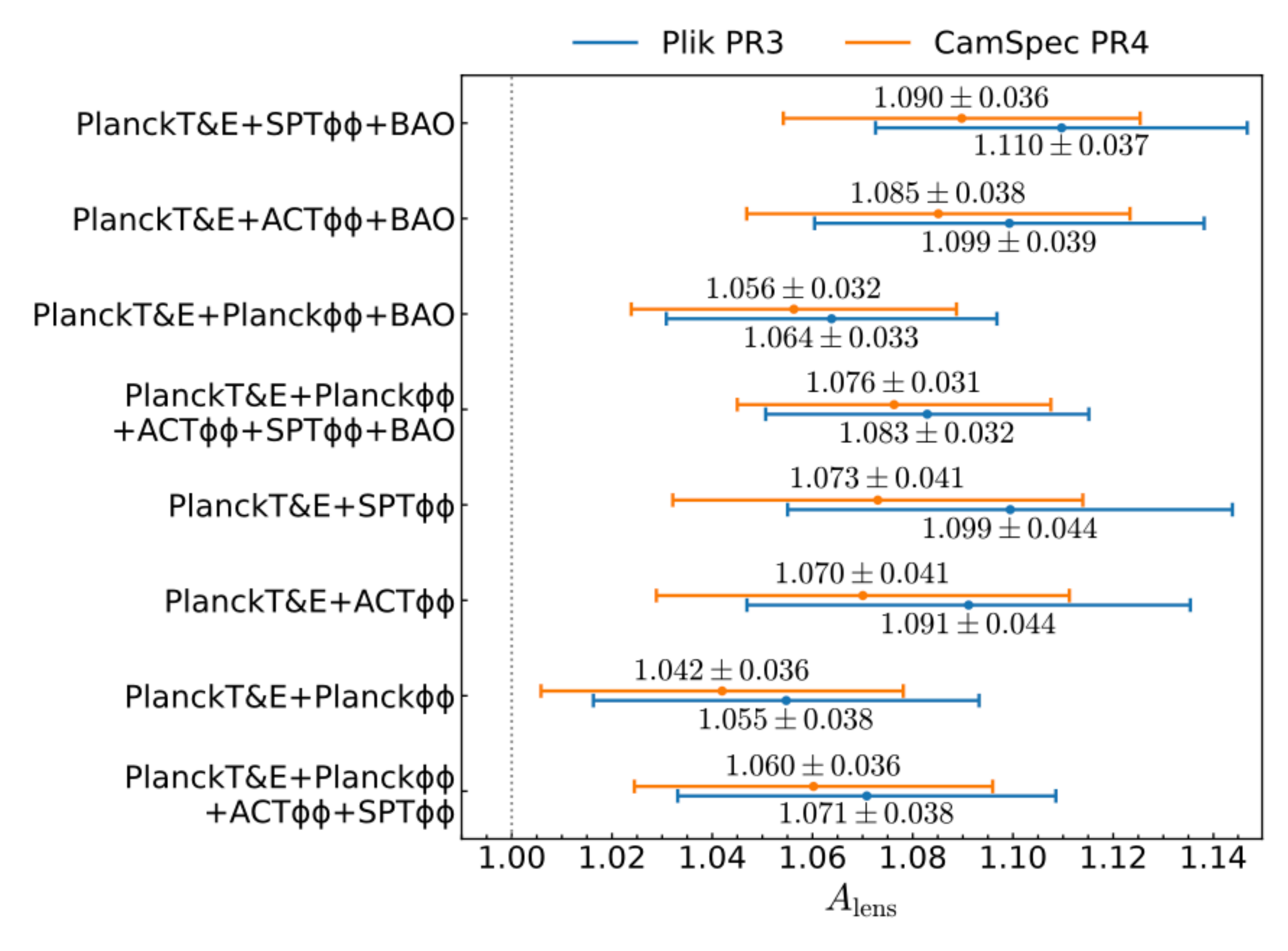
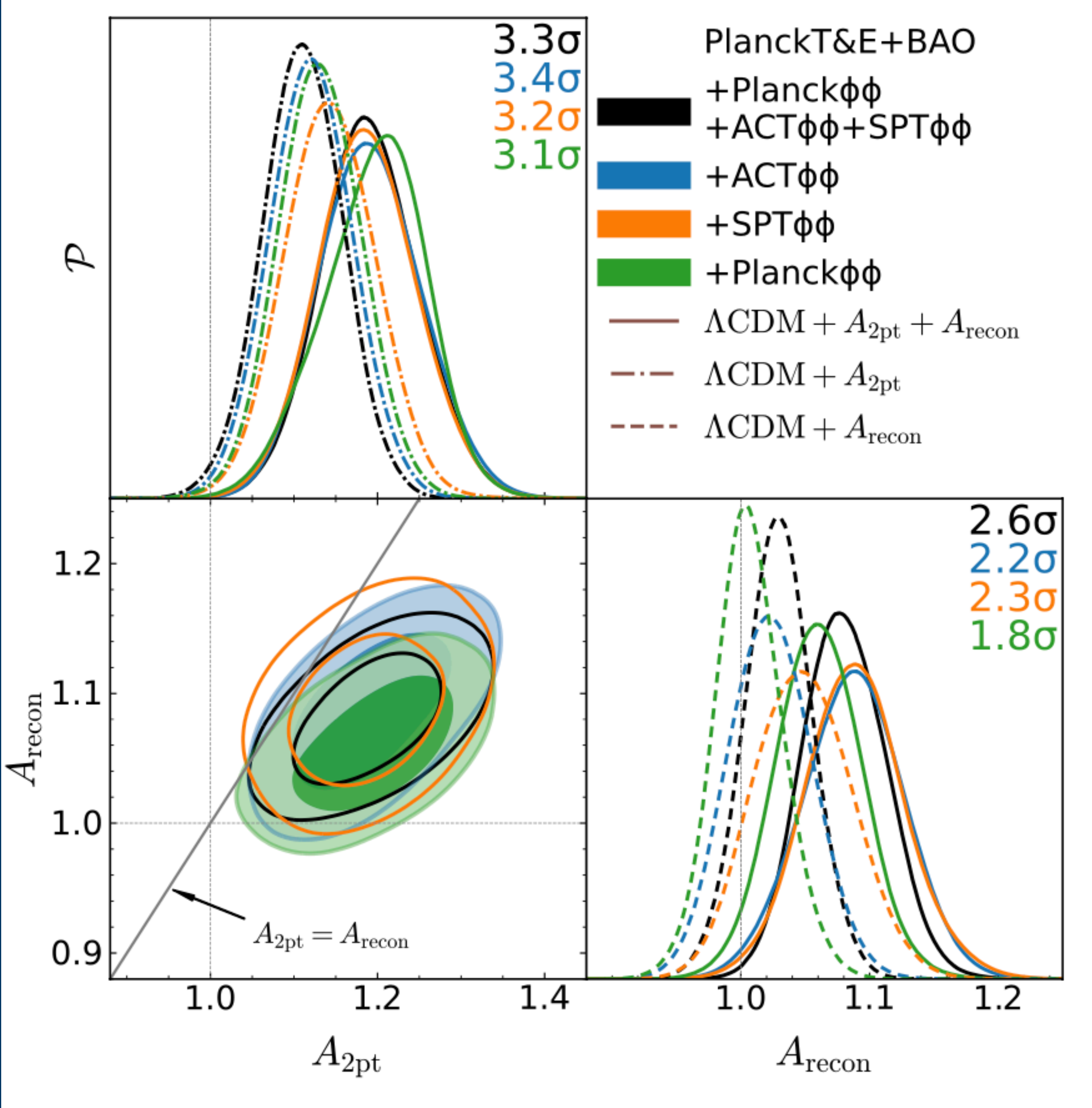
1. There is a "matter density deficit" when combining CMB and BAO data: CMB+BAO prefer ω_{m} less than the CMB-preferred matter density (assuming $\Sigma m_\nu = 0.06\,\mathrm{eV}$) at a $3\,\sigma$ level

2. This is possibly, but not necessarily, related to the lensing excess.

3. BAO constraints on ω_{m} are currently very important for constraints on Σm_ν: caution is warranted when interpreting tight bounds in the $\Lambda\mathrm{CDM} + \Sigma m_\nu$ model space.

Excess lensing problem





Craig et al. 2024 Ge et al. (SPT-3G) 2024 →

Green & Meyers 2024