

Weak Radiative Decays of the B Meson and Bounds on $M_{H^\pm}$ in the Two-Higgs-Doublet Model

Mikołaj Misiak

University of Warsaw

HARMONIA meeting, May 27-29, 2017, Warsaw

based on: [\[MM, M. Steinhauser, Eur. Phys. J. C 77 \(2017\) 201\]](#)

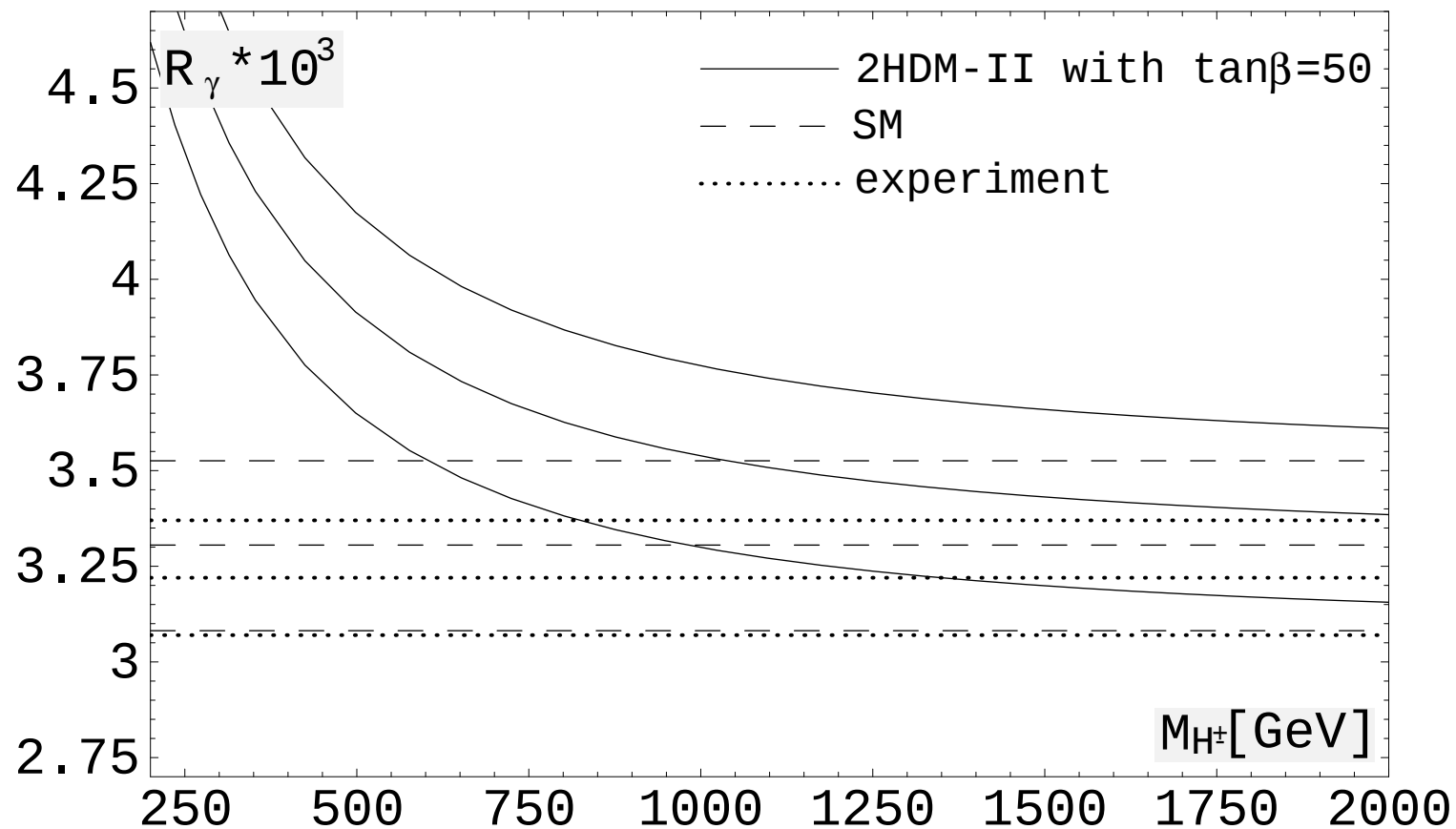
Bounds on $M_{H^\pm}$ from $\bar{B} \rightarrow X_{s,d}\gamma$

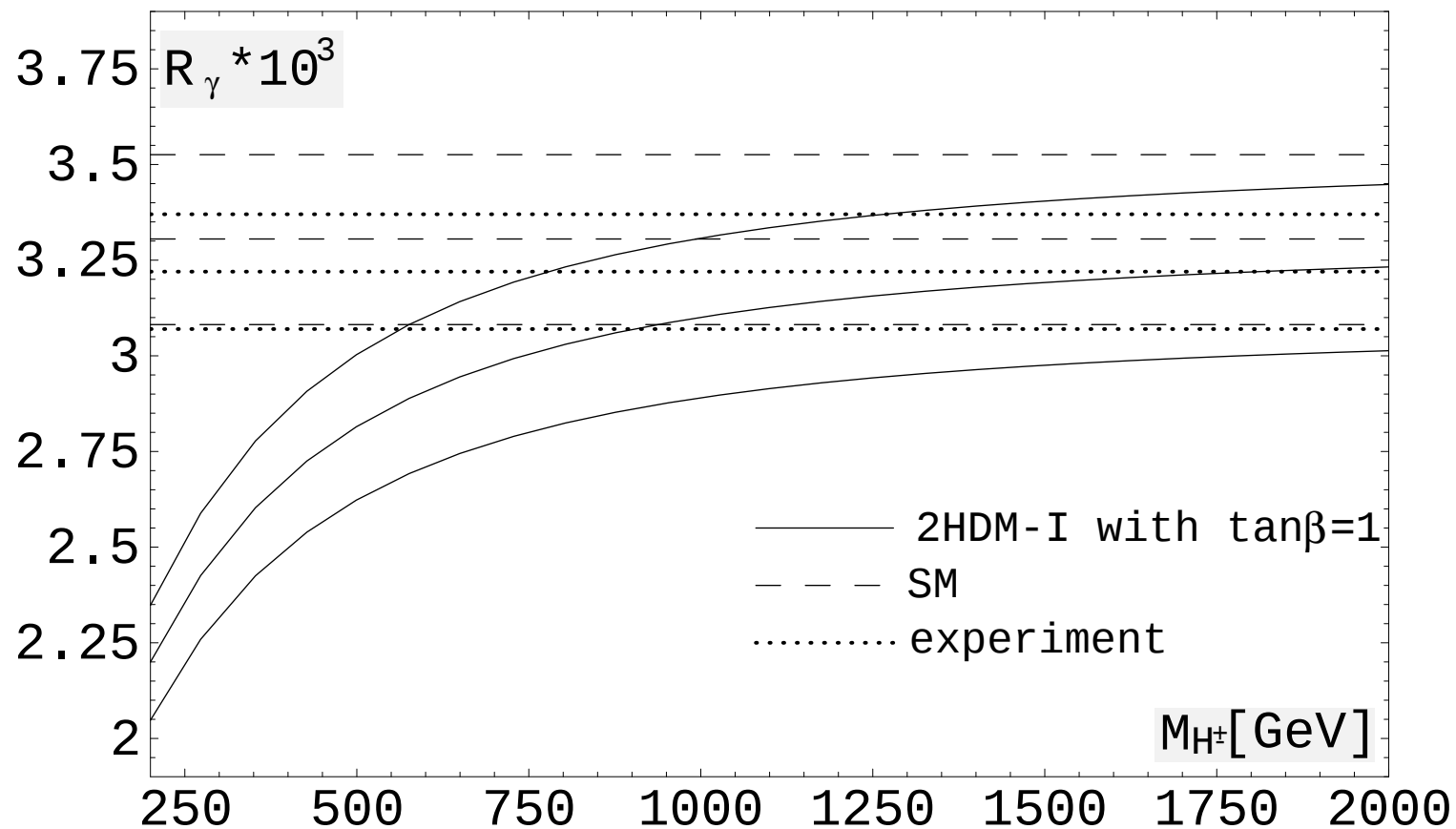
$$R_\gamma = \frac{\mathcal{B}_{s\gamma}+\mathcal{B}_{d\gamma}}{\mathcal{B}_{cl\nu}} \equiv \frac{\mathcal{B}_{(s+d)\gamma}}{\mathcal{B}_{cl\nu}}$$

$$R_\gamma^{\text{SM}} = (331 \pm 22) \times 10^{-5} \quad [\text{arXiv:1503.01789}]$$

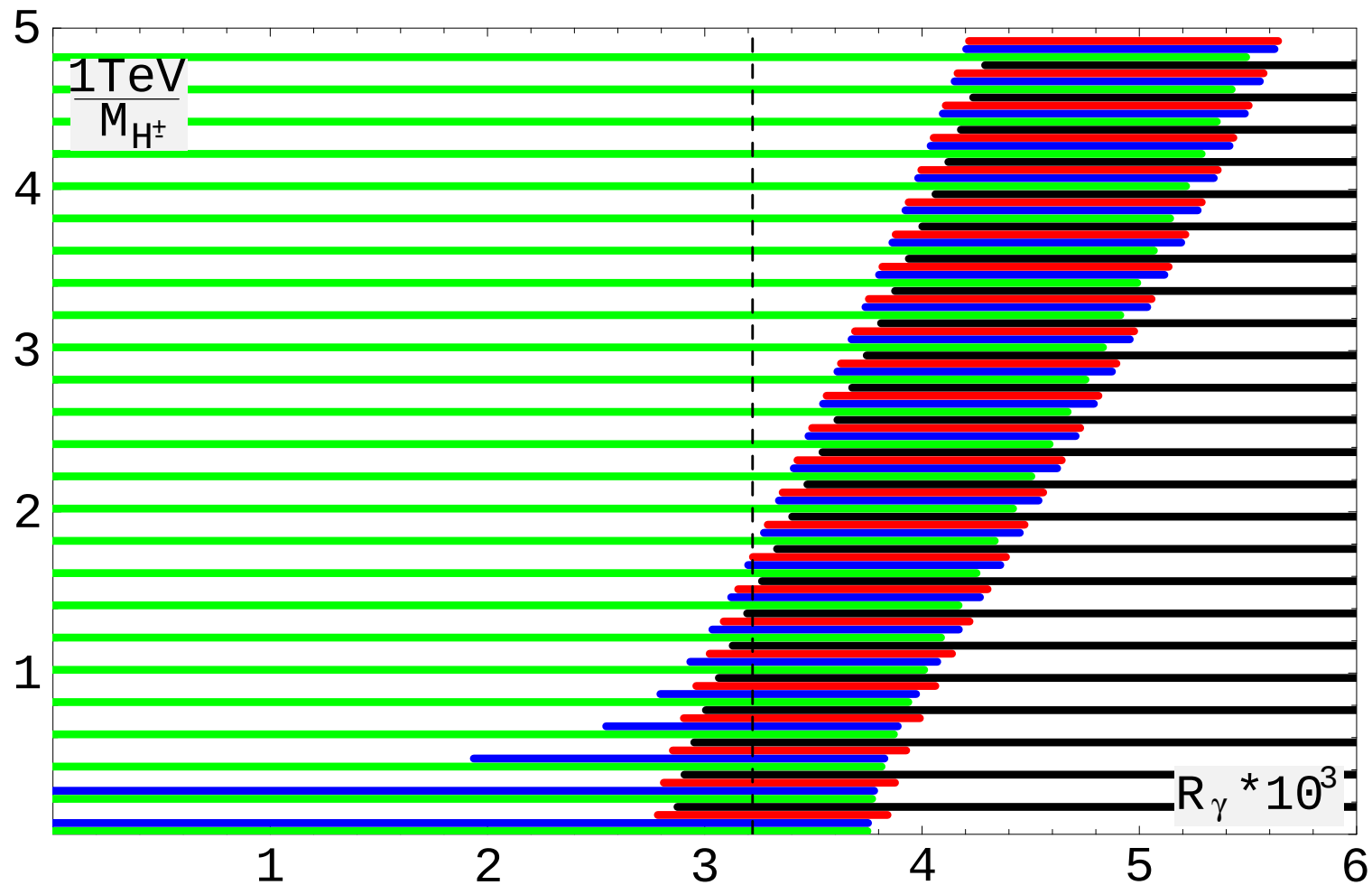
Experimental results and their naive averages:

	Babar				Belle			CLEO	w.a.	w.a.	R_γ	R_γ
E_0	[9]	[44]	[45]	aver	[6]	[46]	aver	[47]	(E_0)	(1.6)	(E_0)	(1.6)
1.7					306(28)		306(28)		306(28)	311(28)		
					320(29)		320(29)		320(29)	326(30)	300(28)	305(28)
1.8	321(34)			321(34)	301(22)		301(22)		307(19)	318(19)		
	335(35)			335(35)	315(23)		315(23)		321(19)	333(20)	301(19)	312(19)
1.9	300(24)	329(52)	366(104)	308(22)	294(18)	351(37)	305(16)		306(13)	327(14)		
	313(25)	344(54)	381(108)	321(23)	307(19)	367(39)	319(17)		320(14)	343(15)	300(14)	322(15)
2.0	280(19)		339(79)	283(18)	279(15)		279(15)	293(46)	281(11)	315(14)		
	292(20)		353(83)	296(19)	292(15)		292(15)	306(49)	294(11)	331(14)	276(11)	310(14)

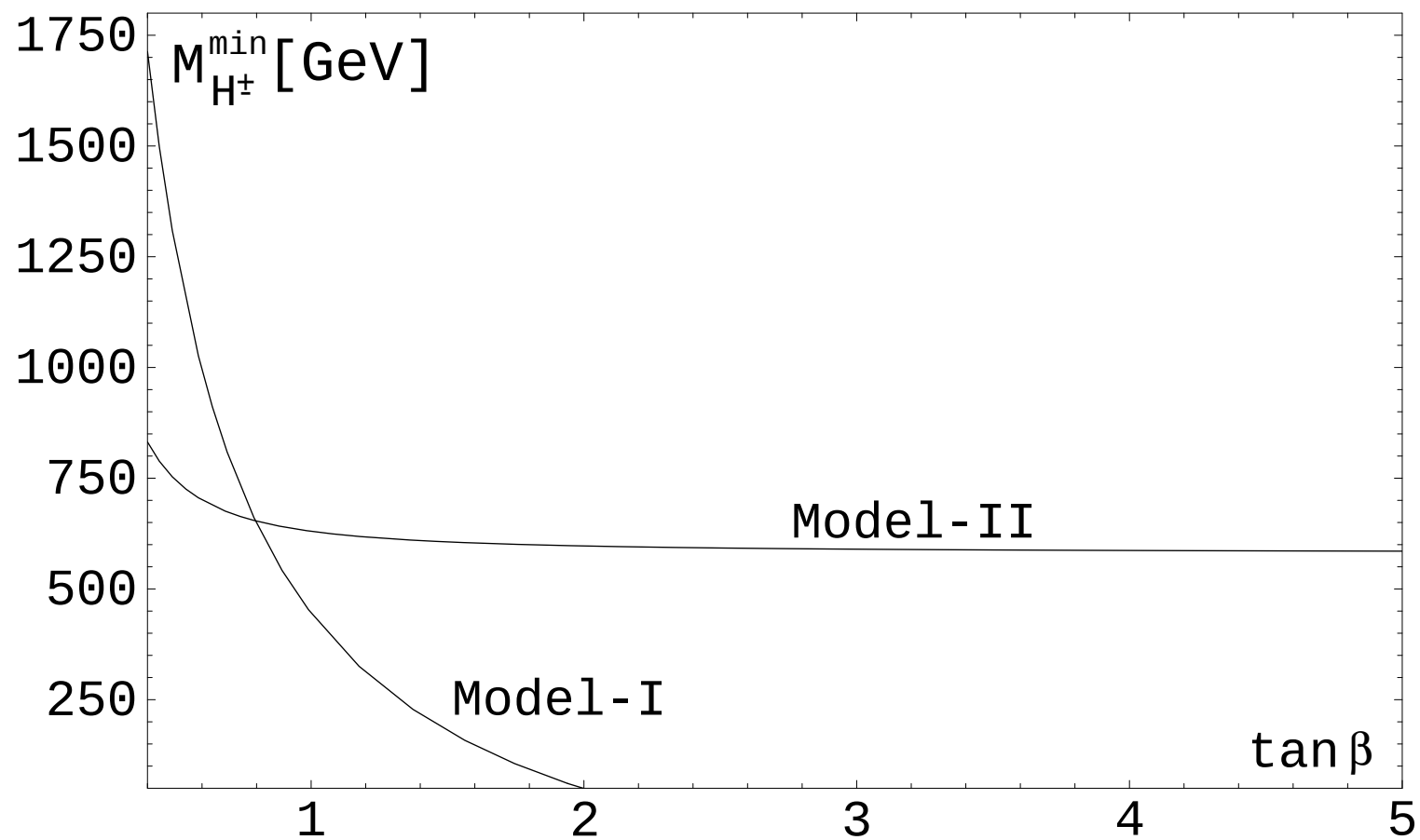


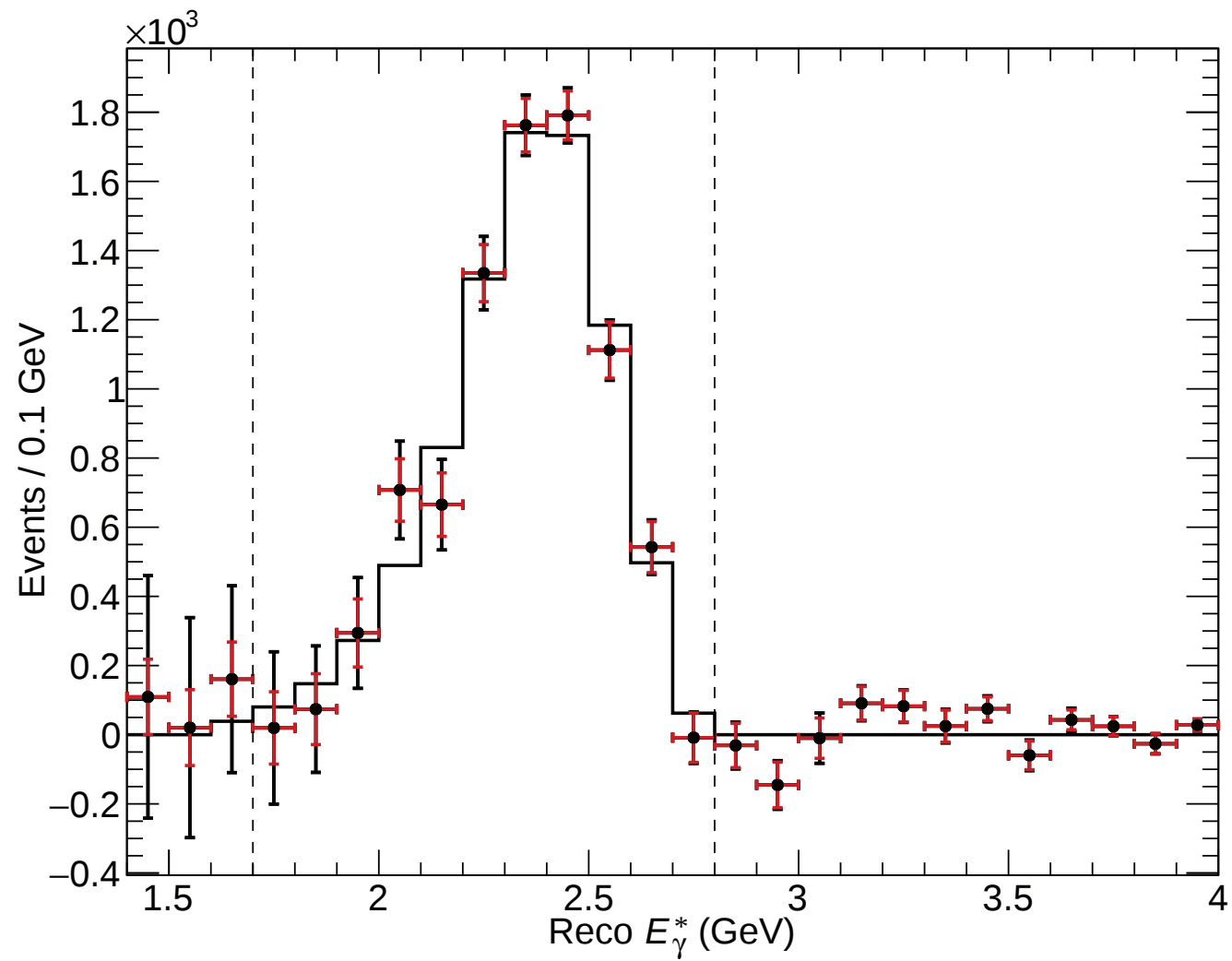


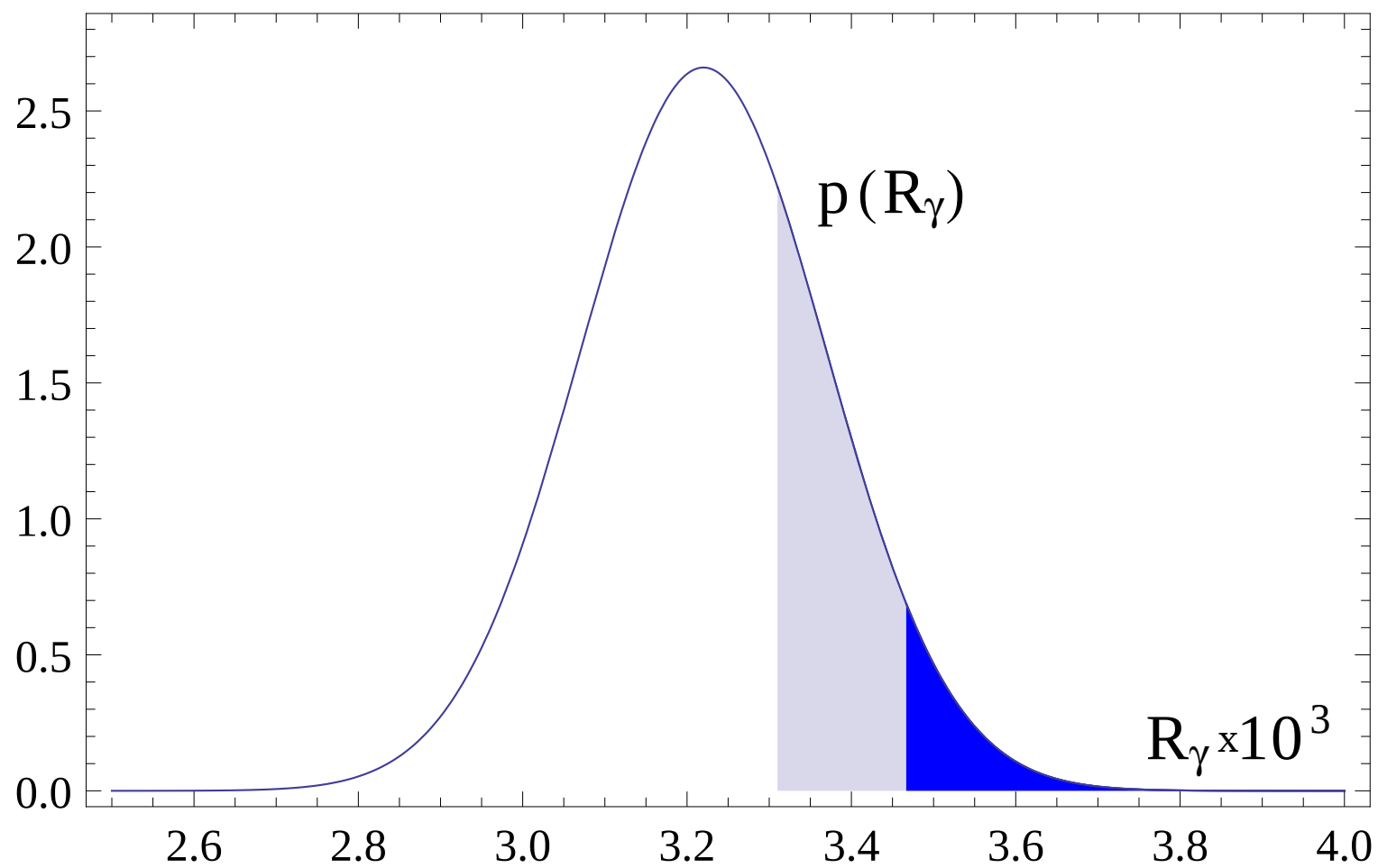
Confidence belts for 2HDM-II



Model	$R_{\gamma}^{\text{exp}} \times 10^3$	95% C.L. bounds			99% C.L. bounds		
		1-sided	2-sided	FC	1-sided	2-sided	FC
I ($\tan \beta = 1$)	3.05 ± 0.28	307	268	268	230	208	208
	3.12 ± 0.19	401	356	356	313	288	288
	3.22 ± 0.15	504	445	445	391	361	361
II (absolute)	3.05 ± 0.28	740	591	569	477	420	411
	3.12 ± 0.19	795	645	628	528	468	461
	3.22 ± 0.15	692	583	580	490	440	439







Summary

Constraints on $M_{H^\pm}$ in the 2HDM get imposed by measurements of the inclusive weak radiative B -meson decay branching ratio. Although in principle straightforward, a derivation of them faces several ambiguities stemming mainly from the photon energy cutoff choice. In Model-I, the relevant constraints are obtained only for $\tan\beta \lesssim 2$. In Model-II, the absolute ($\tan\beta$ -independent) 95% C.L. bounds are in the 570–800 GeV range after the current update.