Tough Questions:

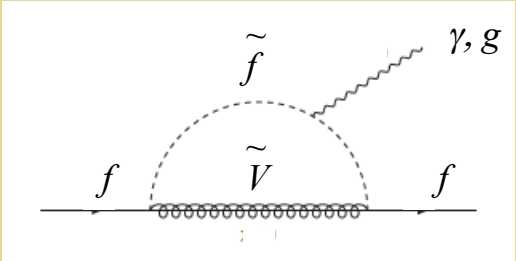
If the LHC does not discover new physics, what can be learned from more precise measurements in the quark flavor sector?

What level of precision is desirable for neutron, electron and atomic EDM experiments in this scenario?

What are some qualitatively interesting thresholds for EDM constraints? (For example, one might be the predictions of SUSY models with very heavy scalars, but sub-TeV gauginos and Higgsinos.)

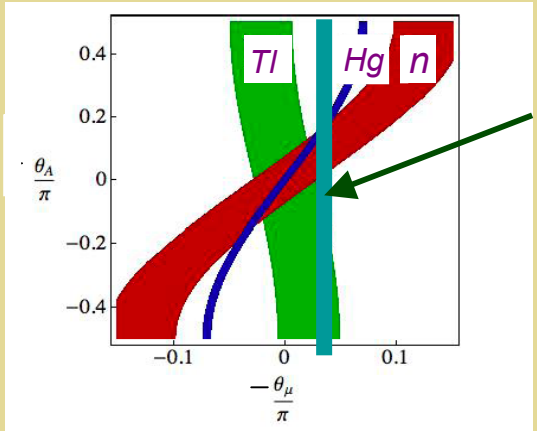
What experimental program is required to reach these thresholds in the coming 5, 10, 20 years?

EDM Thresholds: MSSM Baryogenesis



Universal gaugino phases

$Arg(\mu M_i b^*) = Arg(\mu M_j b^*)$

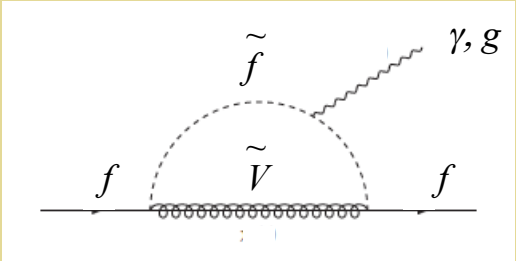


Compatible with observed BAU

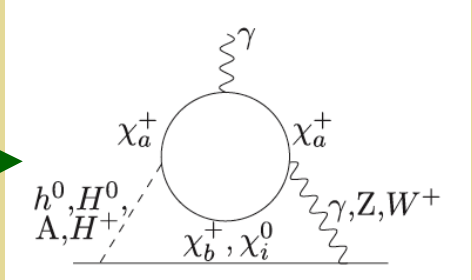
Ritz CIPANP 09 +

Cirigliano, R-M, Tulin, Lee '06

EDM Thresholds: MSSM Baryogenesis



Heavy sfermions



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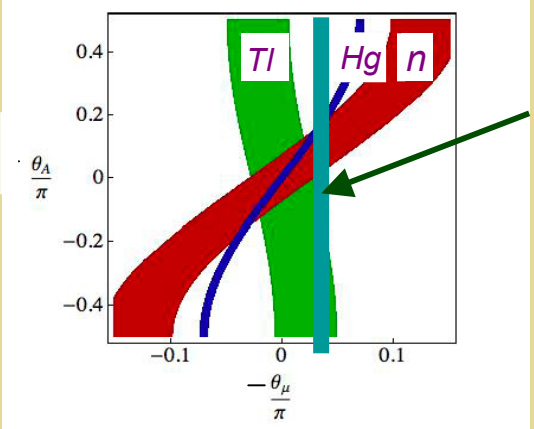

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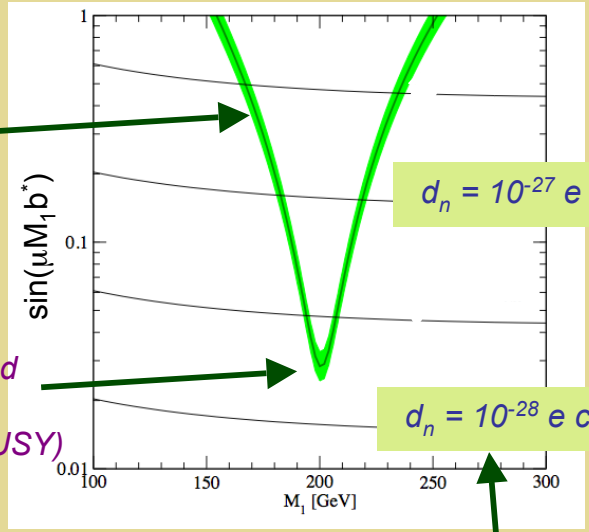

$d_n = 10^{-27}$ e cm

$d_n = 10^{-28}$ e cm

Compressed spectrum (stealthy SUSY)

Li, Profumo, RM '09-'10

Next generation d_n

EDM Experimental Status & Plans

System	Present 90% C.L.	Sensitivity goal[b]	Group
	Limit (e fm)[a]		
Cs	1.2×10^{-10}		[169]
Tl	9.5×10^{-12}		[170]
YbF[d]	10.5×10^{-15}		[152]
ThO[d]	–	$10^{-15} \rightarrow 10^{-17}$	
n	2.7×10^{-13}		[171]
n		$(1-3) \times 10^{-14}$	CryoEDM
n		4×10^{-15}	nEDM/SNS
n		5×10^{-14}	nEDM/PSI
n		5×10^{-15}	n2EDM/PSI
n		2×10^{-15}	nedm/FRM-II Munich
n		$10^{-14} - 10^{-15}$	TRIUMF
p		10^{-16}	srEDM
^{199}Hg	2.6×10^{-16}	$(2.6-5) \times 10^{-17}$	[172]
^{225}Ra		$(10-100) \times 10^{-15}$	Argonne
$^{221/223}$Rn		1.3×10^{-14}	TRIUMF
$^{221/223}$Rn		2×10^{-15}	FRIB
^{129}Xe	5.5×10^{-14}		[173]

Engel, R-M, van Kolck, 1303.2371
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Hadronic Matrix Elements: QCD Theory

Param		Coeff	Best value[a]	Range
$\bar{\theta}$		α_n	0.002	(0.0005–0.004)
		α_p	0.002	(0.0005–0.004)
$\mathrm{Im}\, C_{qG}$	*(CEDM)*	β_n^{uG}	4×10^{-4}	$(1-10) \times 10^{-4}$
		β_n^{dG}	8×10^{-4}	$(2-18) \times 10^{-4}$
$\mathrm{Im}\, C_{q\gamma}$	*(EDM)*	$\beta_n^{u\gamma}$	0.4×10^{-3}	$(0.2-0.6) \times 10^{-3}$
		$\beta_n^{d\gamma}$	-1.6×10^{-3}	$-(0.8-2.4) \times 10^{-3}$
$C_{\tilde{G}}$	*(3 G)*	$\beta_n^{\tilde{G}}$	2×10^{-7}	$(0.2-40) \times 10^{-7}$
$\mathrm{Im}\, C_{\varphi ud}$	*(qqH)*	$\beta_n^{\varphi ud}$	3×10^{-8}	$(1-10) \times 10^{-8}$
$\mathrm{Im}\, C_{quqd}^{(1,8)}$	*(4q)*	β_n^{quqd}	40×10^{-7}	$(10-80) \times 10^{-7}$

Neutron EDM sensitivity to CPV sources

Engel, R-M, van Kolck, 1303.2371
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