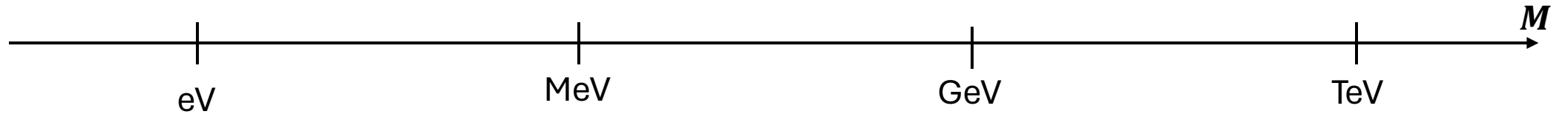


# Light New Physics at B Factories

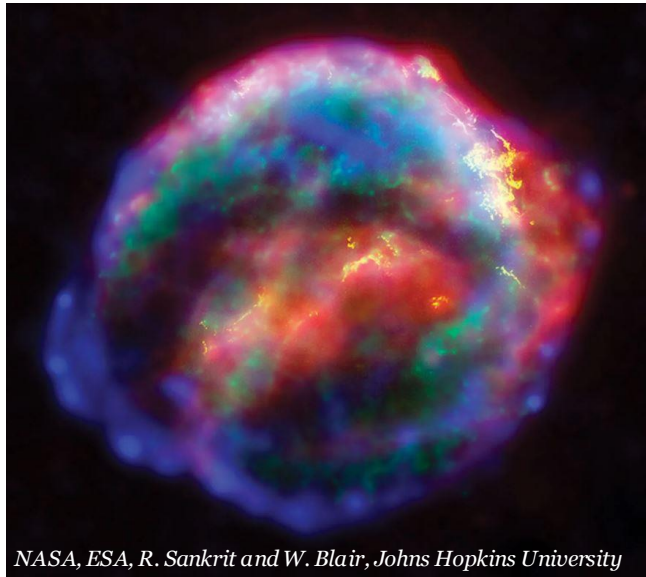
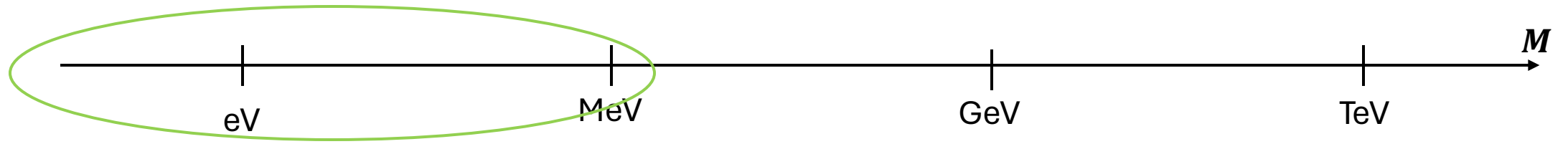


*Speaker: Vazha Loladze*

# Search of New Physics

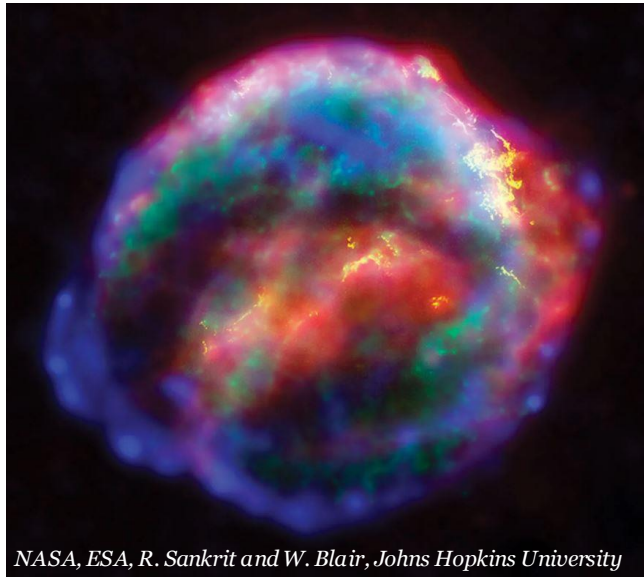
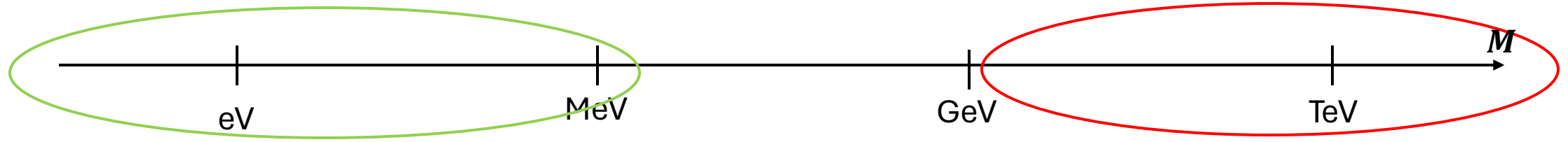


# Search of New Physics

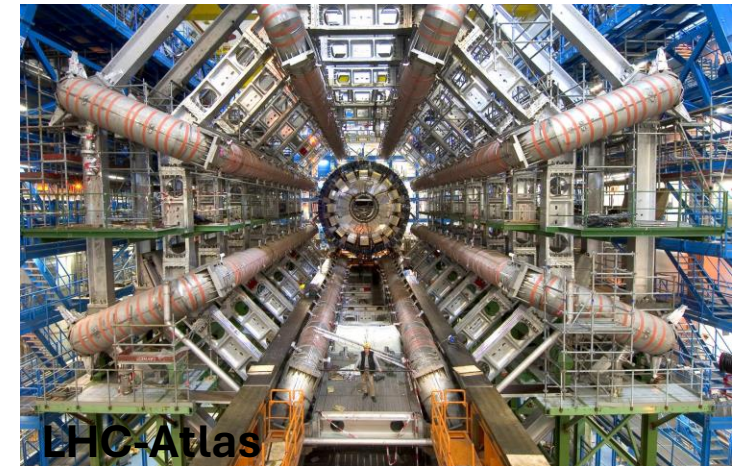


Astrophysics/  
Cosmology

# Search of New Physics

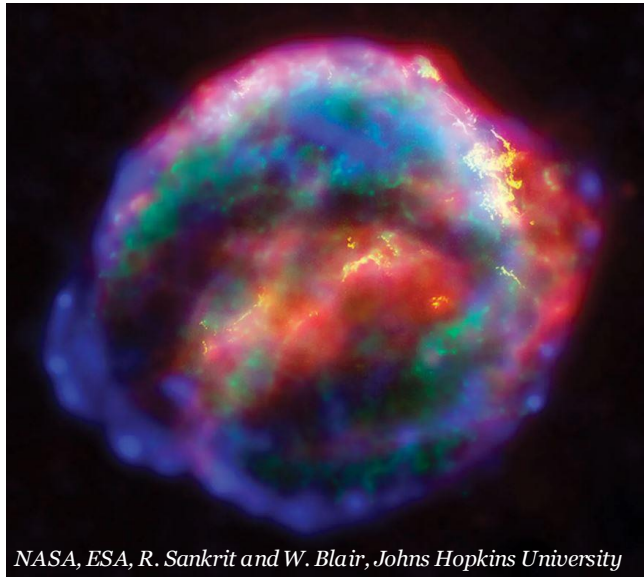
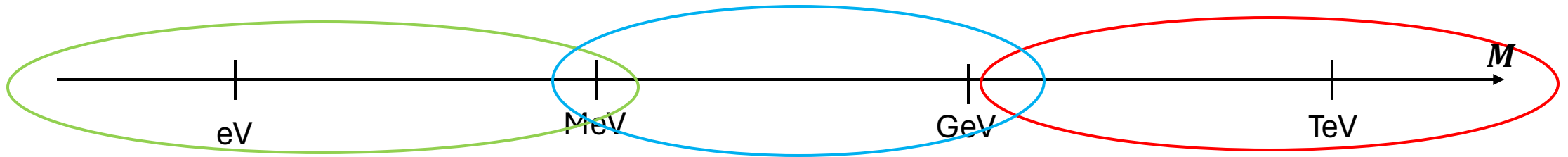


Astrophysics/  
Cosmology

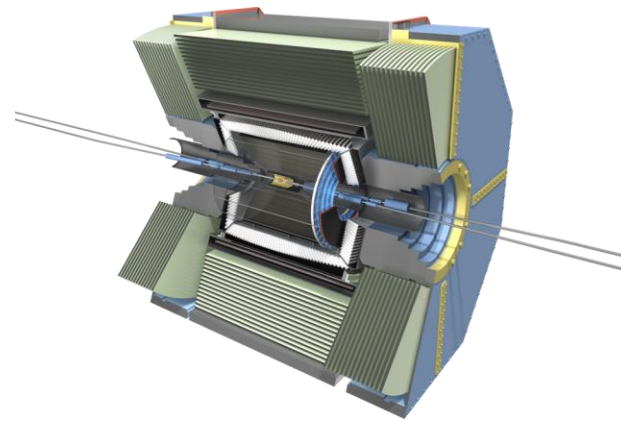


High Energy  
Colliders

# Search of New Physics

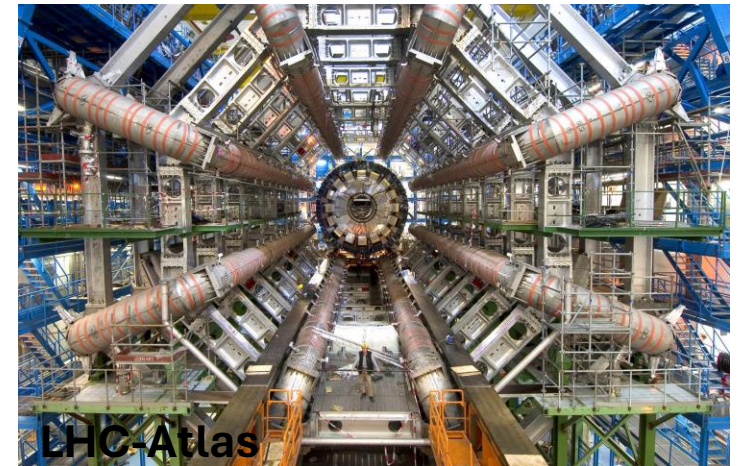


Astrophysics/  
Cosmology



**Belle II**

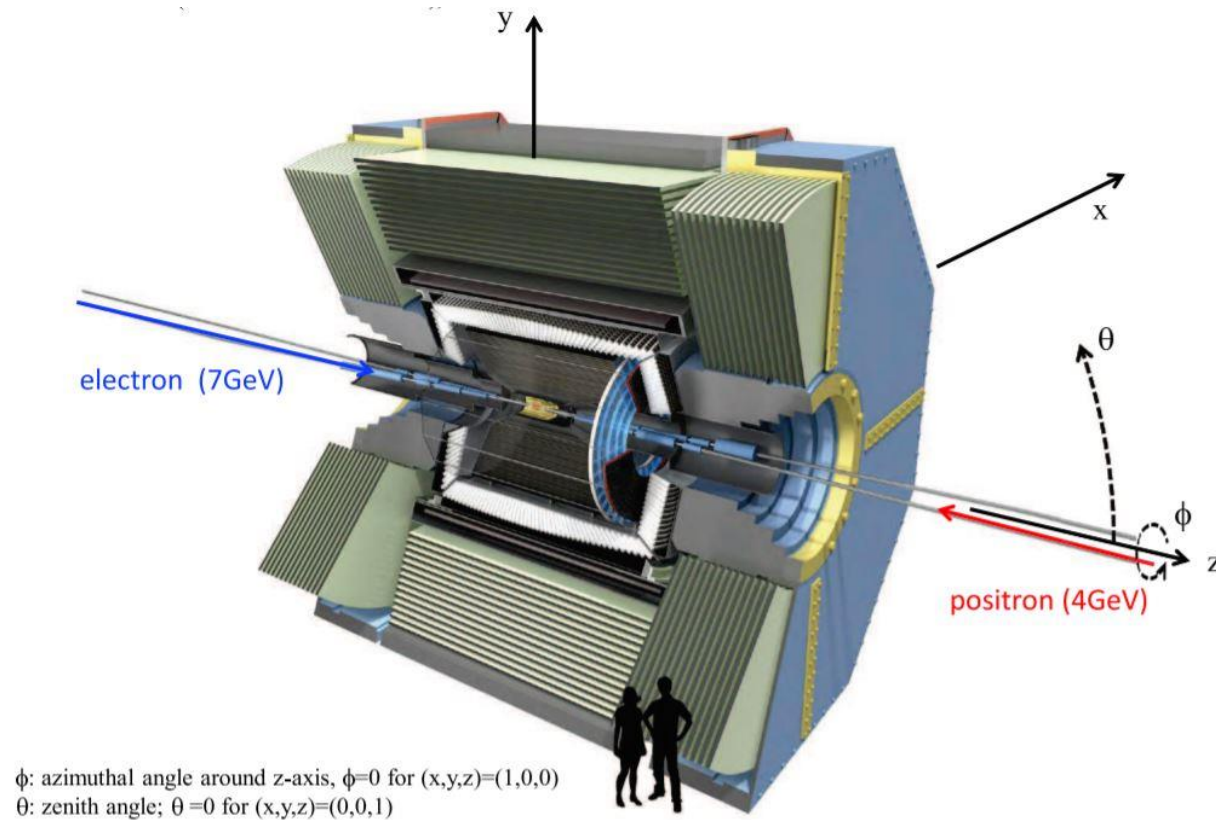
High Intensity  
Experiments



**LHC-Atlas**

High Energy  
Colliders

# Belle II



planned luminosity  $50 \text{ ab}^{-1}$  ( $5 \times 10^{10} \bar{B}B$ )

# Example: Axion

Introduce new  $U(1)_{PQ}$  symmetry anomalous under QCD:

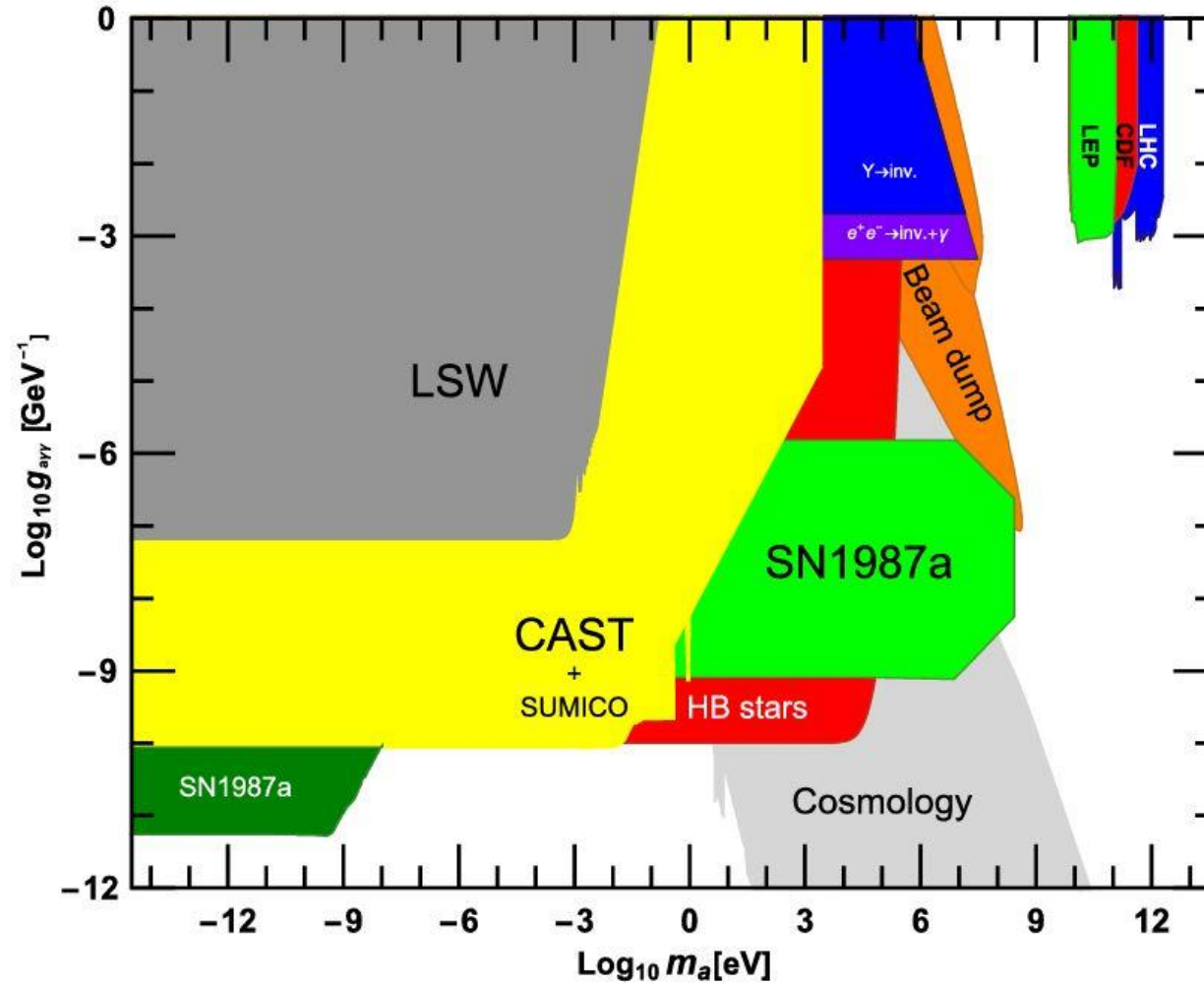
$$\mathcal{L} = \dots + \bar{\theta} \frac{g^2}{32\pi^2} G_{\mu\nu} \tilde{G}^{\mu\nu} + \frac{1}{2} (\partial_\mu a)^2 + \frac{g^2}{32\pi^2} \frac{a}{f_a} G_{\mu\nu} \tilde{G}^{\mu\nu}$$
$$V_{\text{eff}}(a) \sim m_\pi^2 f_\pi^2 \left( 1 - \cos\left(\bar{\theta} + \frac{a}{f_a}\right) \right)$$

As a result:

$$\bar{\theta} + \frac{a}{f_a} \approx 0 \Rightarrow \text{The Strong CP problem is solved!}$$

$$m_a \sim \frac{m_\pi f_\pi}{f_a} \Rightarrow \text{QCD axion is very light!}$$

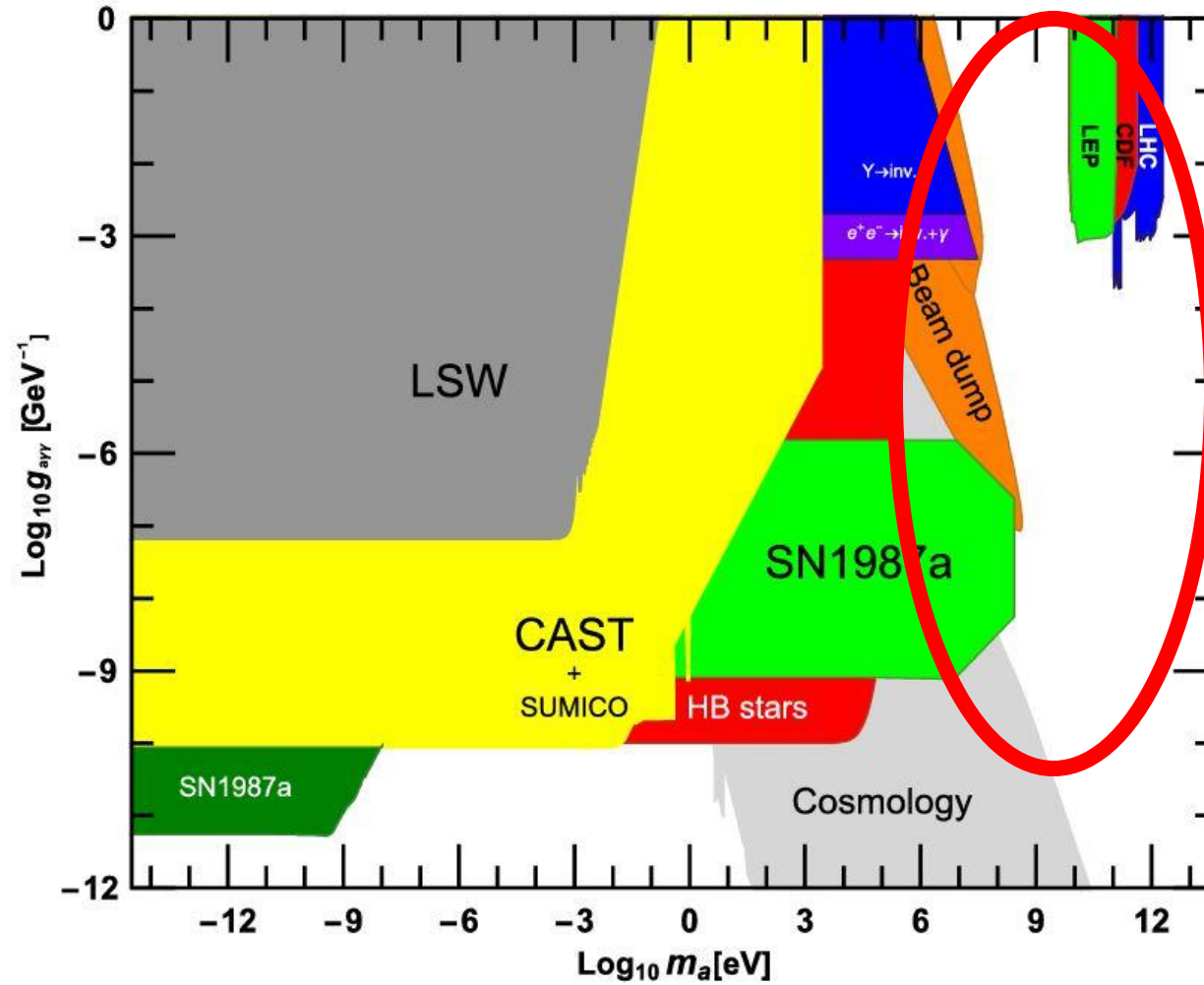
# Bounds on axion



J. Jaeckel and M. Spannowsky,  
*Phys. Lett. B* 753 (2016) 482-487

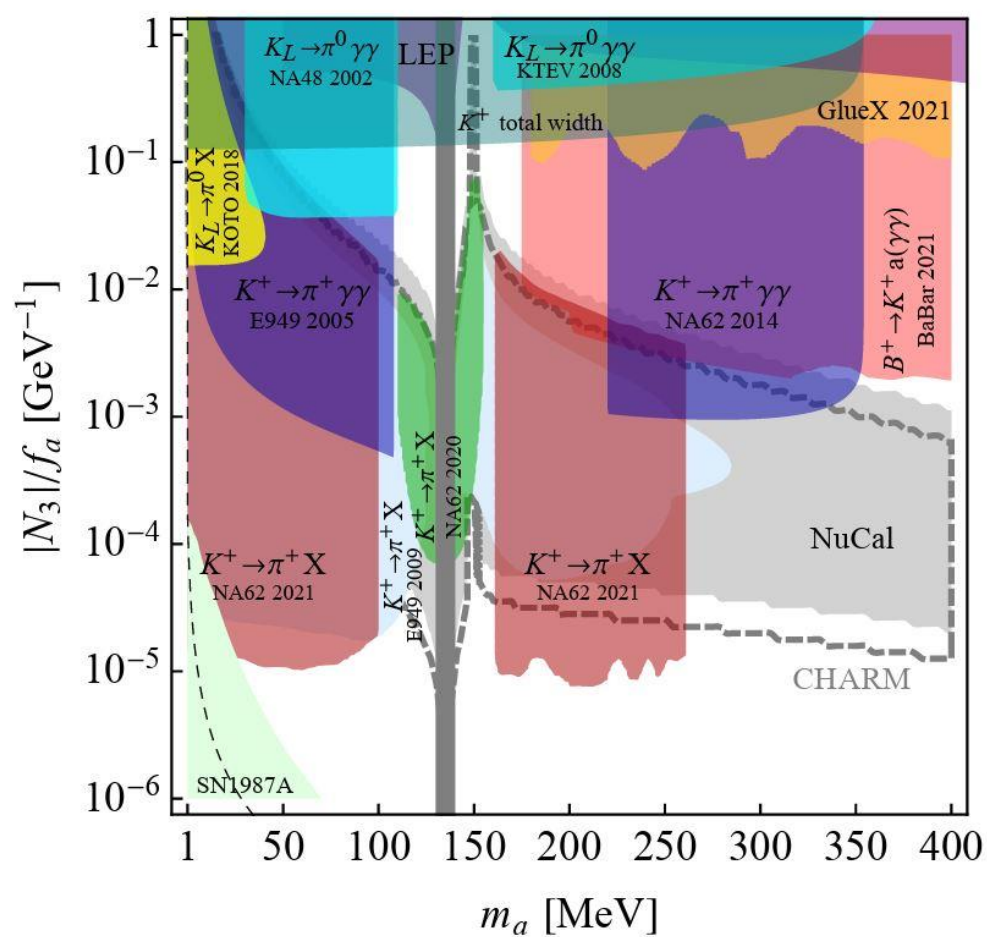


# Bounds on axion

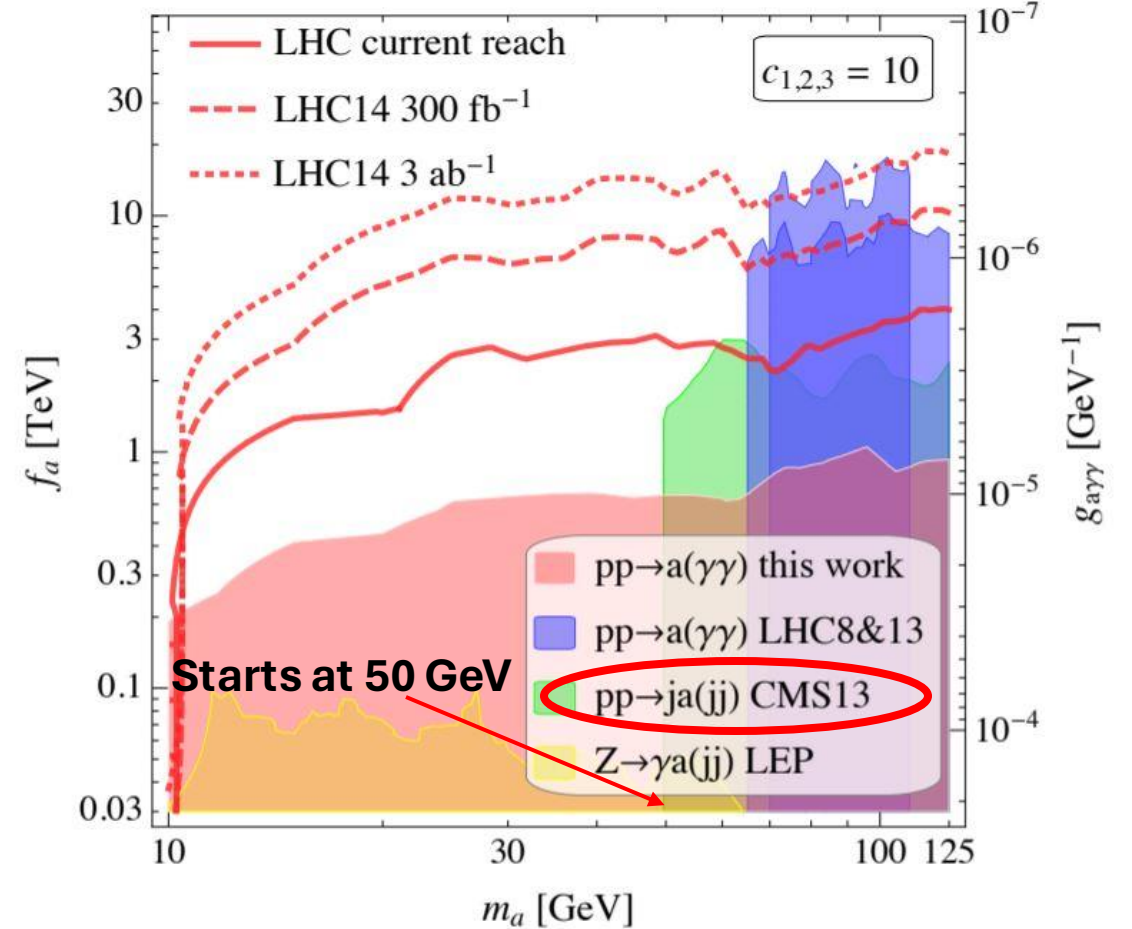


J. Jaeckel and M. Spannowsky,  
*Phys. Lett. B* 753 (2016) 482-487

# Axion at Light Meson Experiments and LHC

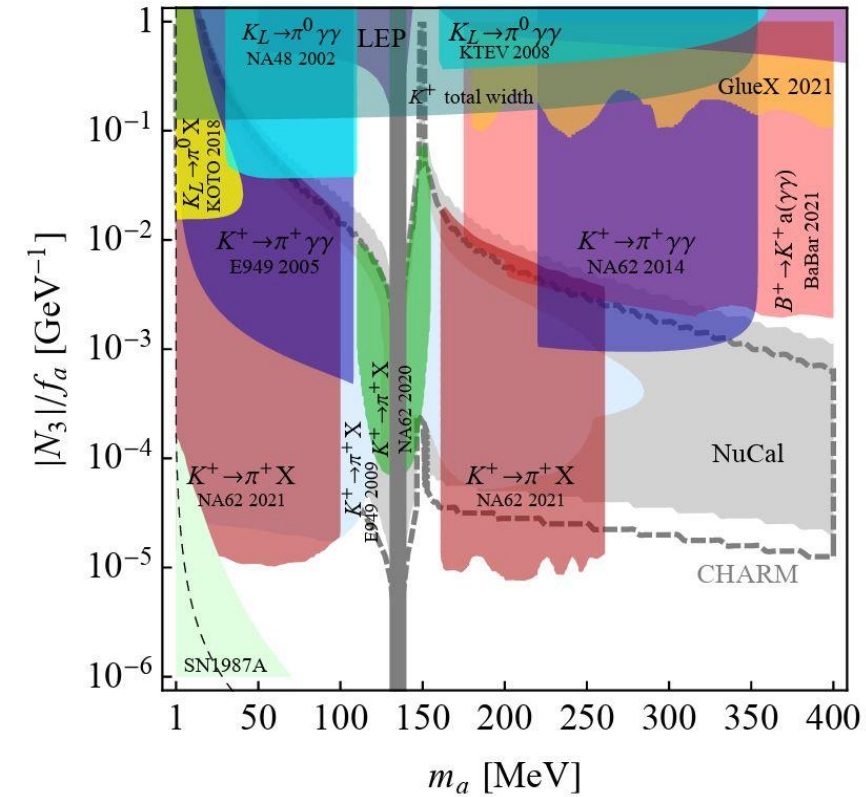


Evgueni Goudzovski Et al, *Rept.Prog.Phys.* 86 (2023) 1, 016201



A. Mariotti, D.Redigolo, F. Sala, K. Tobioka, *Phys.Lett.B* 783 (2018) 13-18

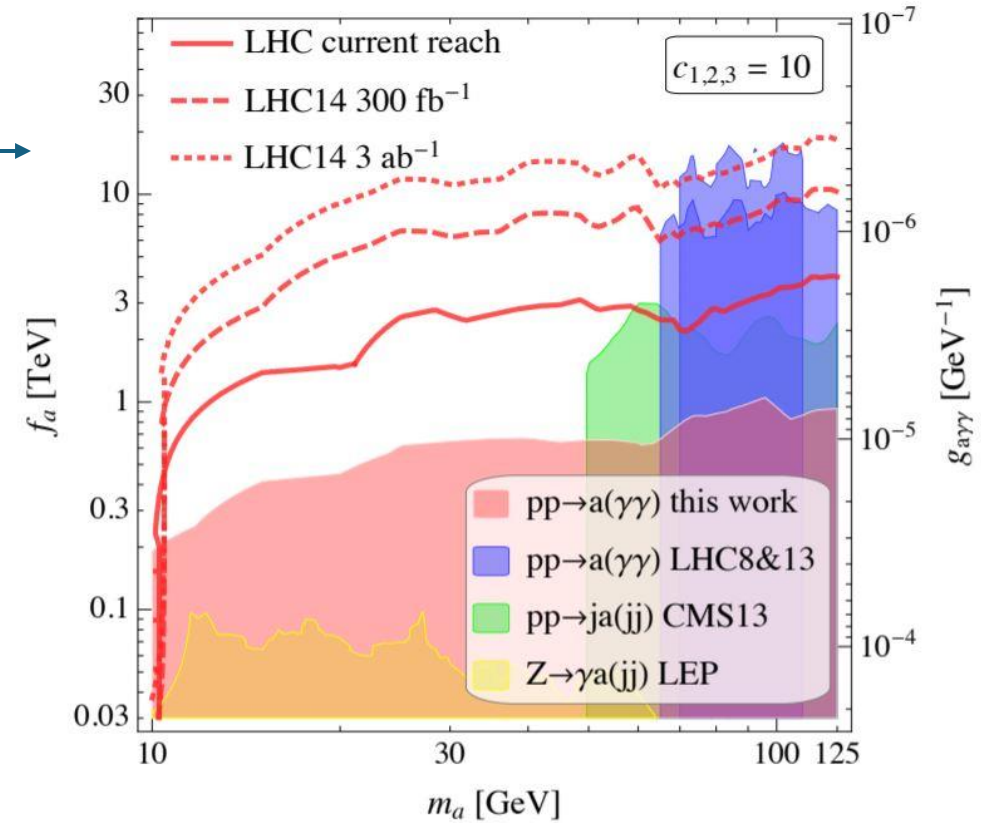
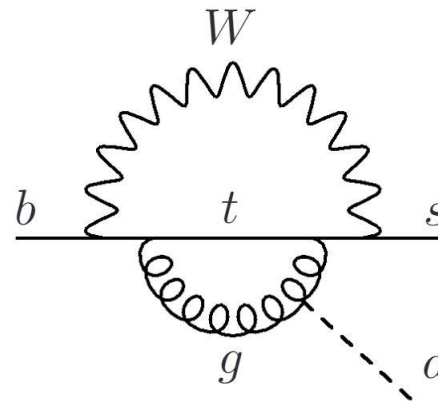
# Axion and B physics



## B physics

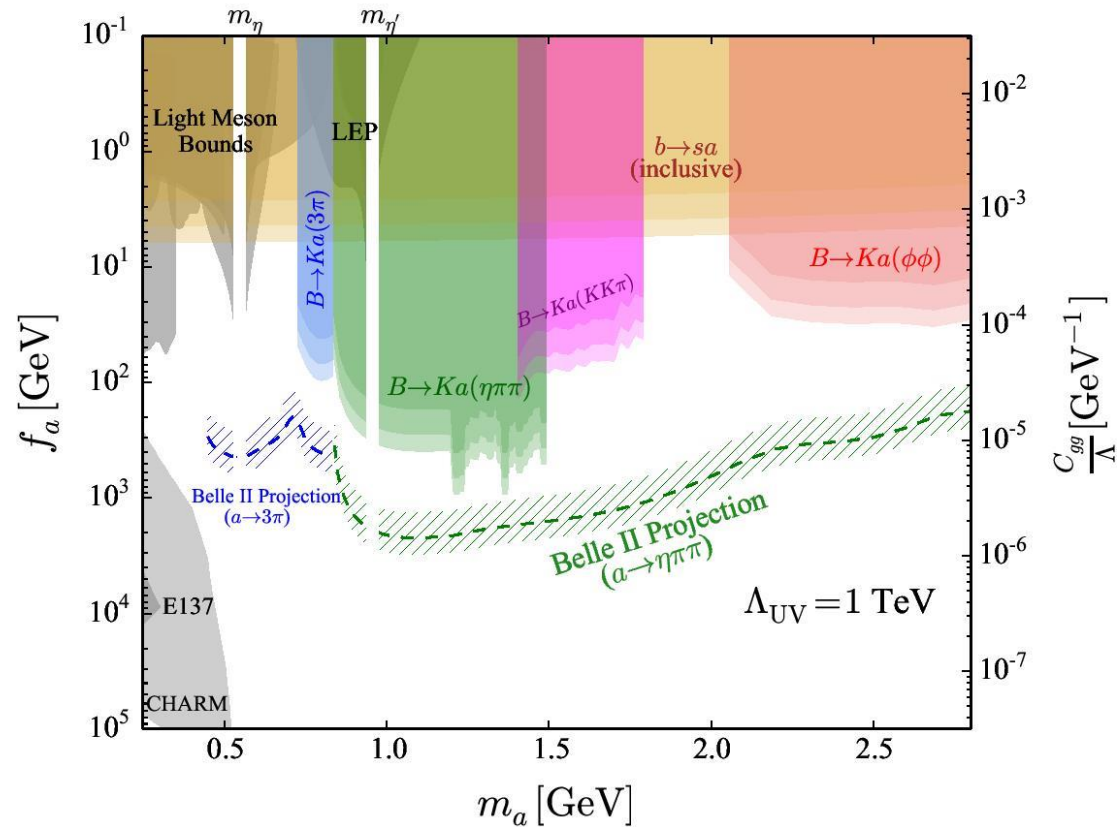
1.  $M_B \approx 5 \text{ GeV}$
2. Huge statistics (BABAR, BELLE, LHCb, BELLE II)
3. Relatively clean production channel

### $B \rightarrow Ka$

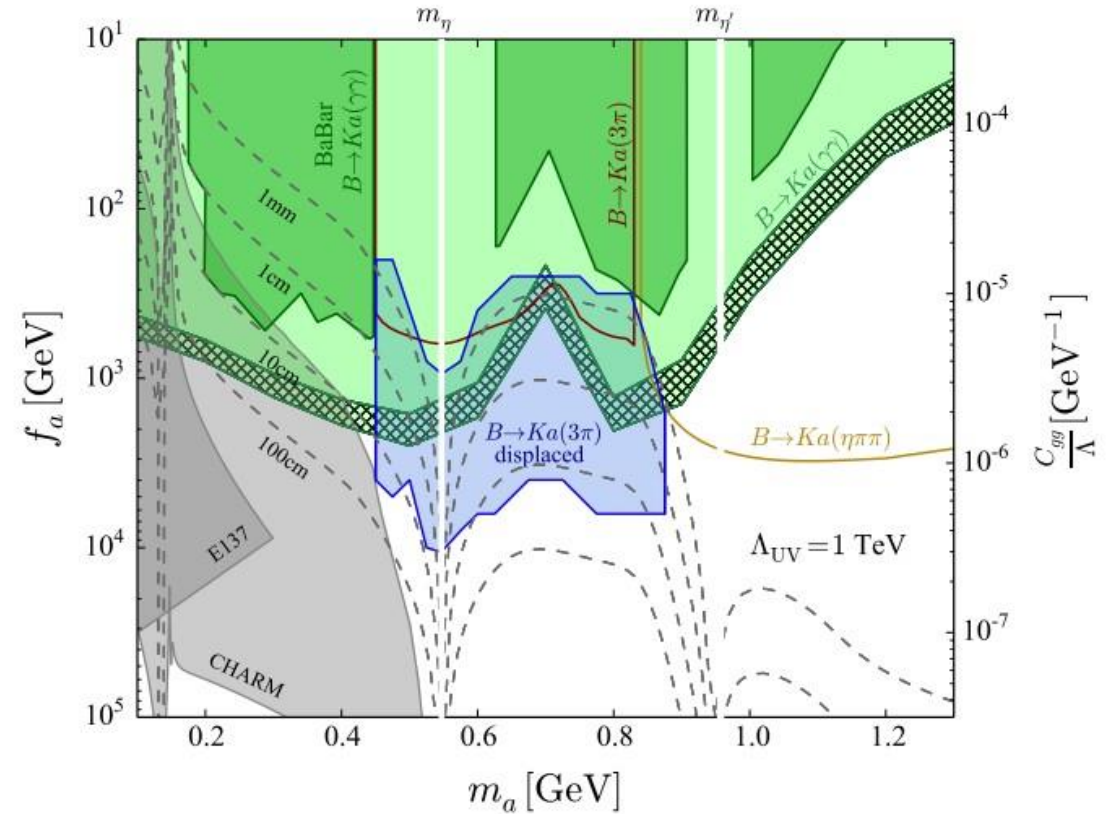


Calculation done in: S. Chakraborty, M. Kraus, V. L., T. Okui, and K. Tobioka, *Phys.Rev.D* 104 (2021) 5, 055036

# Phenomenology



S. Chakraborty, M. Kraus, **V. L.**, T. Okui, and K. Tobioka, *Phys.Rev.D* 104 (2021) 5, 055036



E. Bertholet, S. Chakraborty, **V. L.**, T. Okui, A. Soffer, and K. Tobioka, *Phys.Rev.D* 105 (2022) 7, L071701

**Thank you for your attention!**