The Search for Axion Like Particles (ALPs) in $B^0 \to K^{*0} a_0, a_0 \to \gamma\gamma$

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Background and Motivation

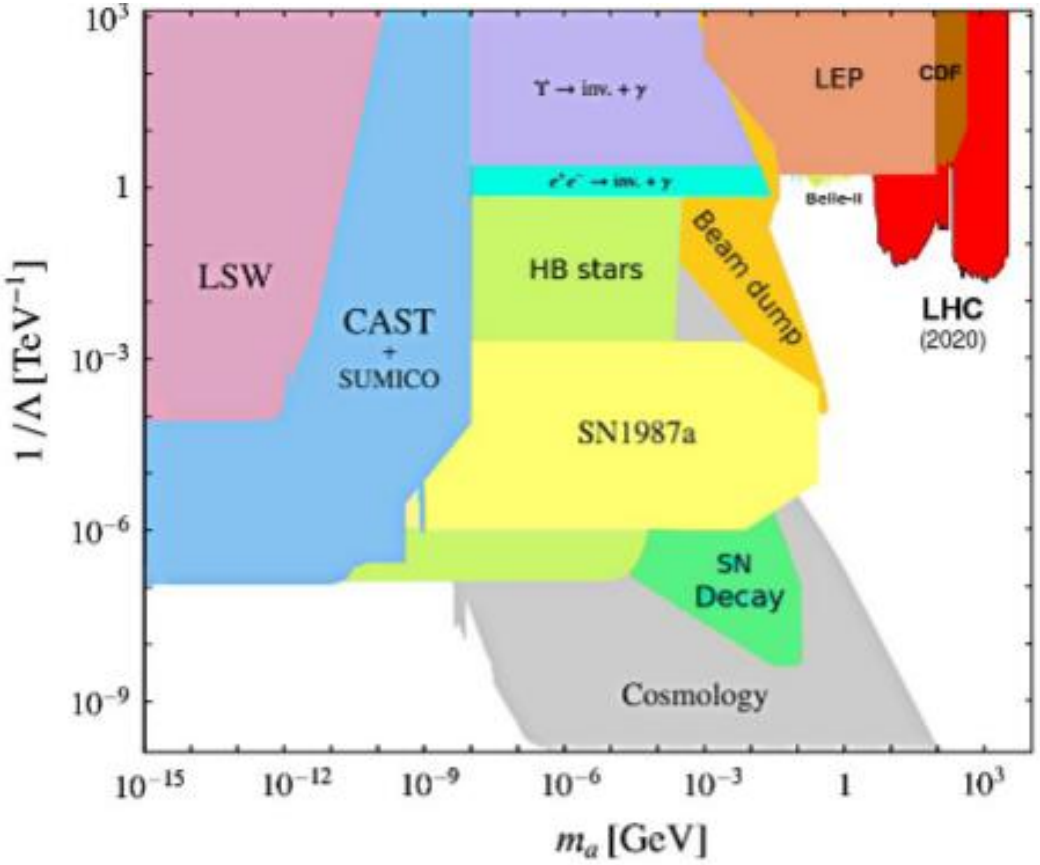
- "By-product" of motivation behind axions (which were proposed to solve Strong CP problem)*
- Spontaneous breaking of an approximate symmetry **(not PQ)** can also generate other **axion-like particles (ALPs).**
- Couple predominantly to pairs of gauge bosons (e.g. $gg, \boldsymbol{\gamma\gamma}, ZZ, \gamma Z, W^{\pm}$etc.) depending on the model being considered**
- Can explain anomalies in energy loss of white dwarf stars (among other astrophysical conundrums)
- Potential dark matter candidate

* R D Peccei (2006) *Axions and the Strong CP Problem*: https://arxiv.org/abs/hep-ph/0607268

** Ringwald (2014) *Axions and Axion-Like Particles:* https://arxiv.org/pdf/1407.0546.pdf

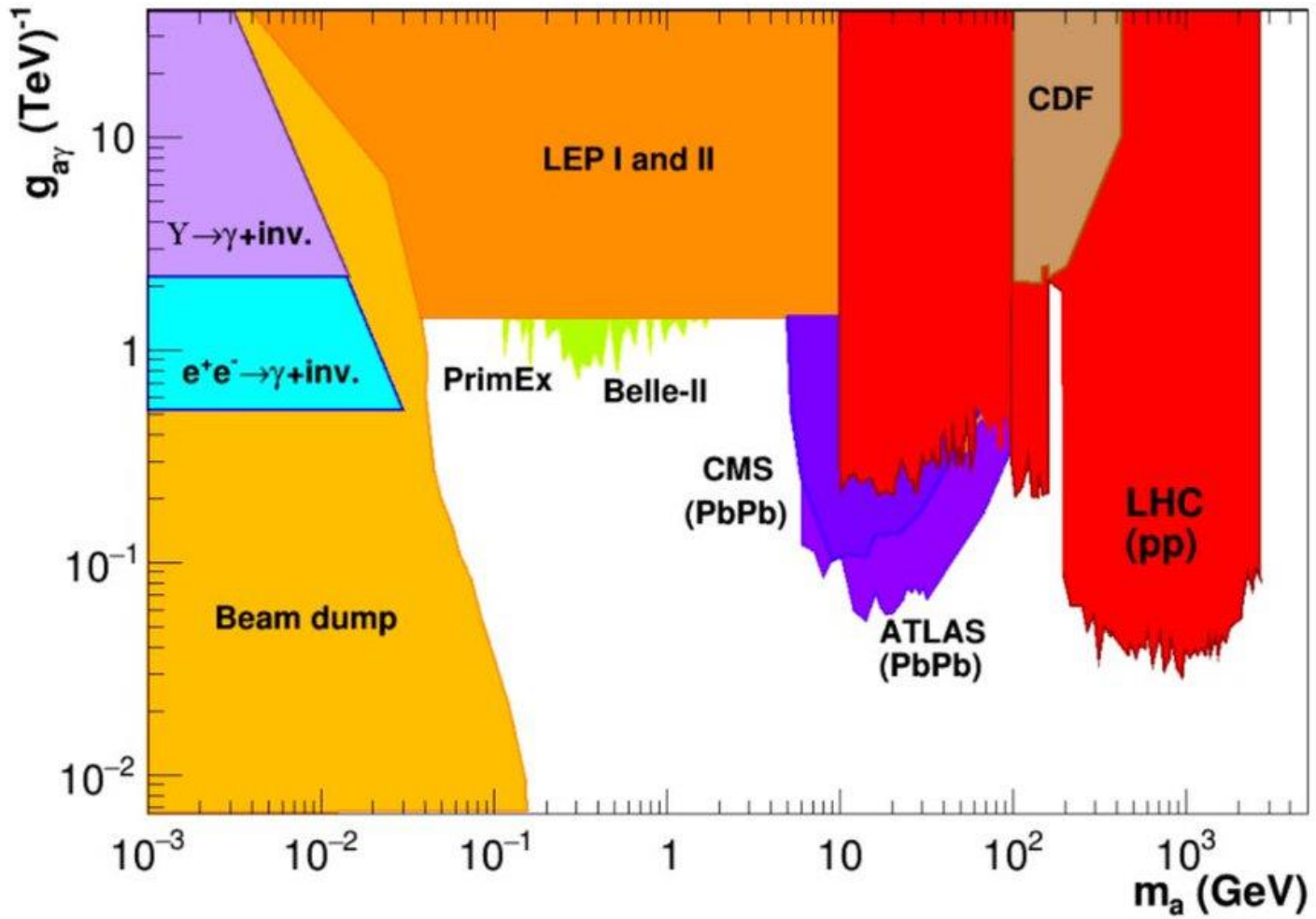
Experimental Searches for Axions and ALPs

- Spin-selection rules => light pseudoscalars naturally couple to photons
- Search strategies generally exploit the (inverse) Primakoff effect
- Notable search strategies (excluding collider searches):
  - **LSW (Light Shining Through Walls) Experiments**
    - **Any Light Particles Search (ALPS I)**
    - **ALPS II**
  - **Helioscope Searches**
    - **International Axion Observatory (IAXO)**
    - **CERN Axion Space Telescope (CAST)**
  - **Haloscope Searches**
    - **Axion Dark Matter Experiment (ADMX)**
    - **PIXIE**
    - **PRISM CMB**



Source: A. Ringwald. *Axions and axion-like particles*, 2014.

Summary of Mass and Coupling Constraints



Electromagnetic Trigger Study

- Preliminary studies to look at how events will survive EM trigger in Run 2 data
- Seek to determine how $\varepsilon_{sel}^{\gamma\gamma}$ varies as a function of ALP mass
- Will determine if efficiency using $B \rightarrow K^{*}\gamma$ stripping is high enough to make an analysis for Run 1 and 2. Otherwise aim at Run 3.