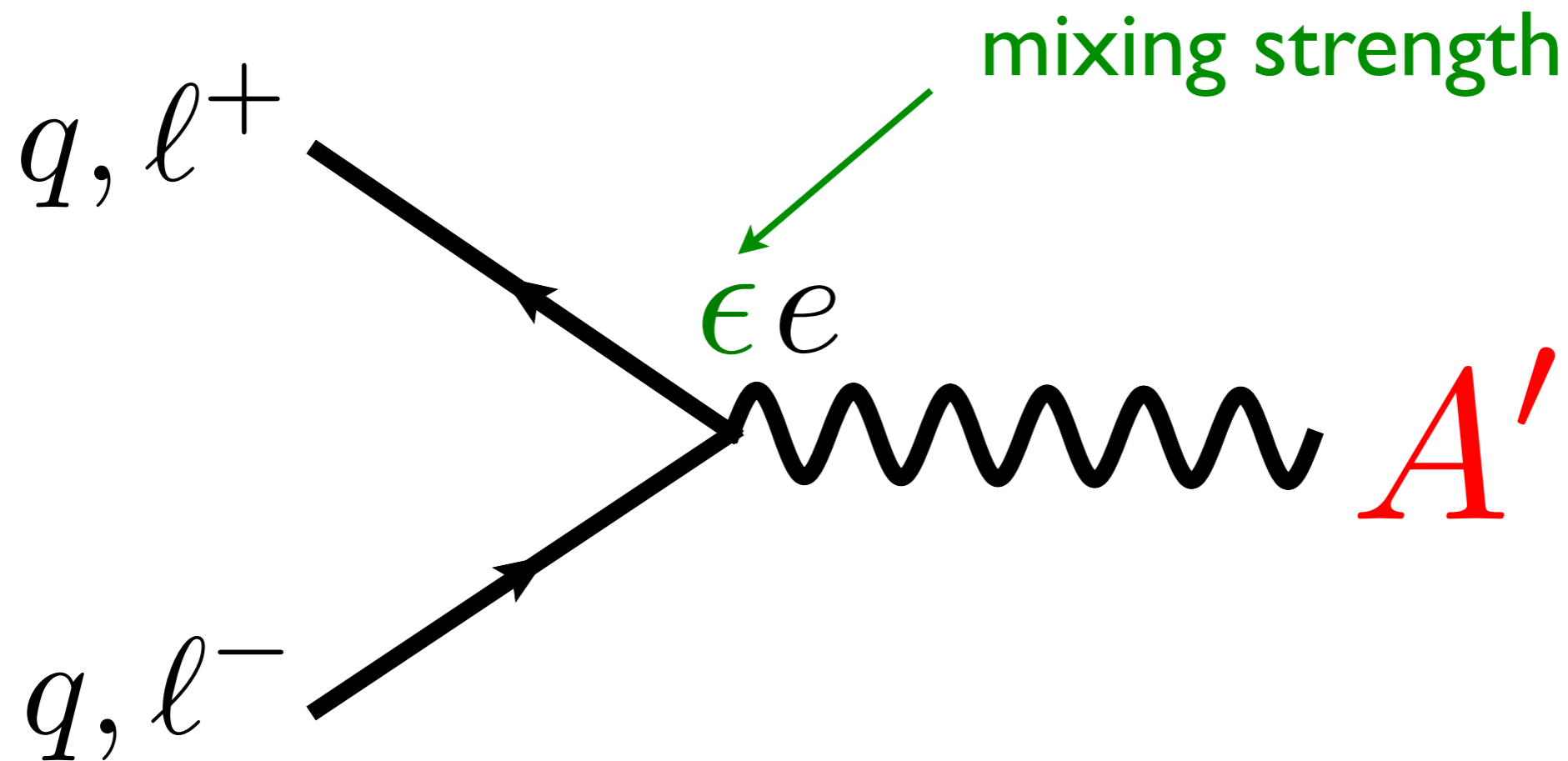


# Brief update on status of dark photons

Rouven Essig

APEX phone meeting, 3/14/2014

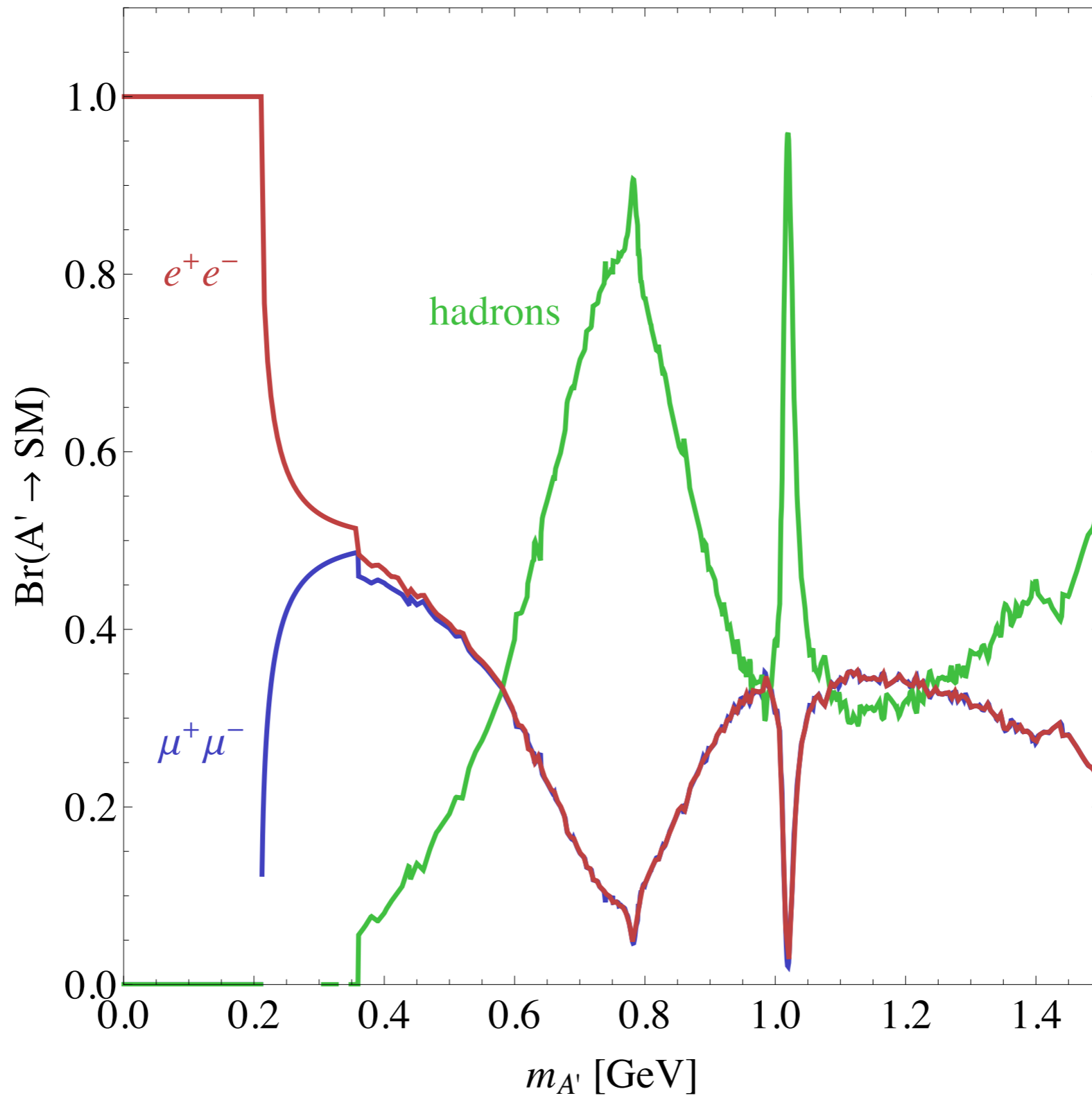
# $A'$ couples to Quarks and charged Leptons



allows production of  $A'$  in  $e^+e^-$  colliders, electron & proton beam dumps, meson decays etc.

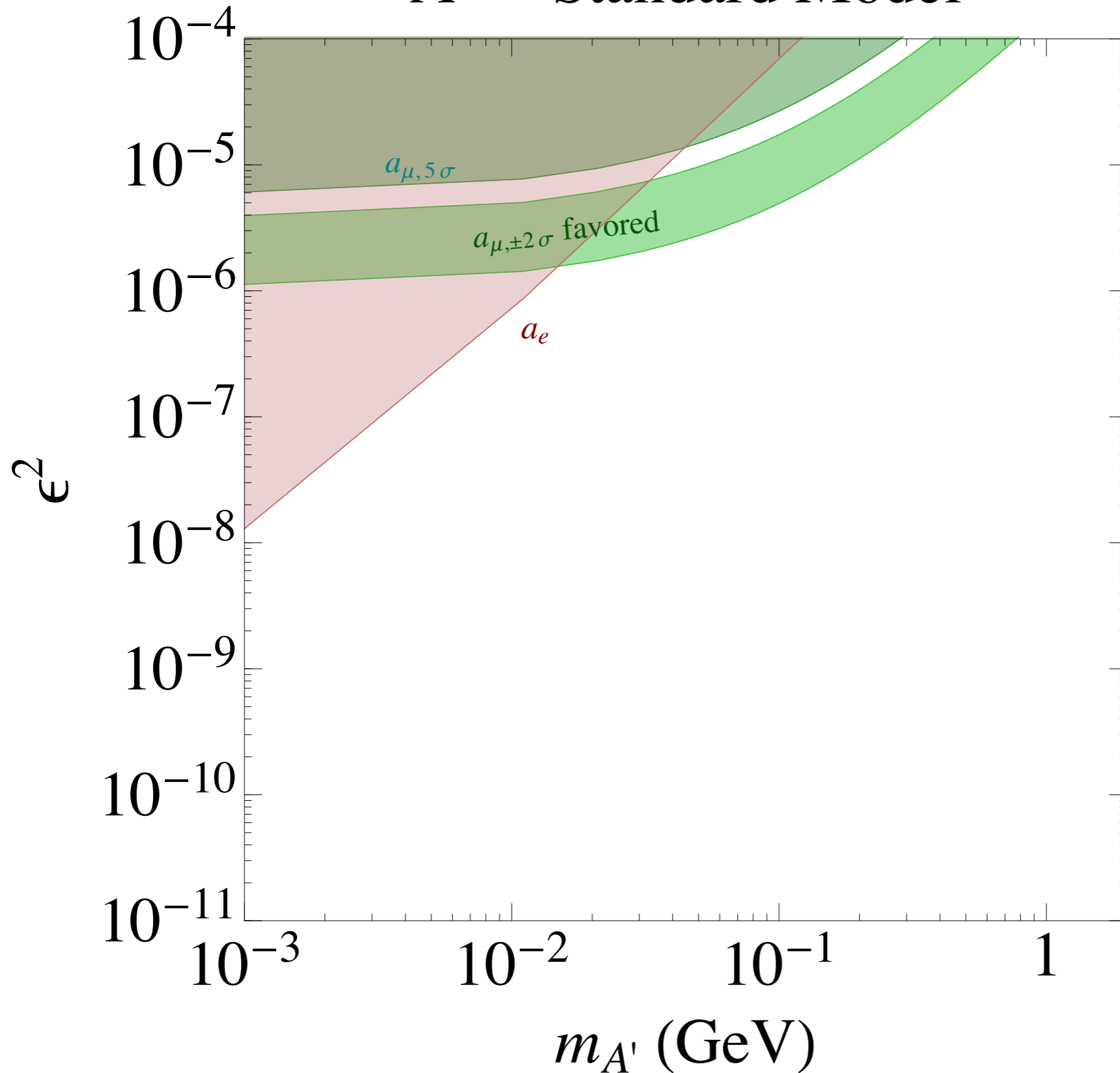
consider only  $A'$  masses  $> 1$  MeV

# $A'$ decays



# Status ~2008

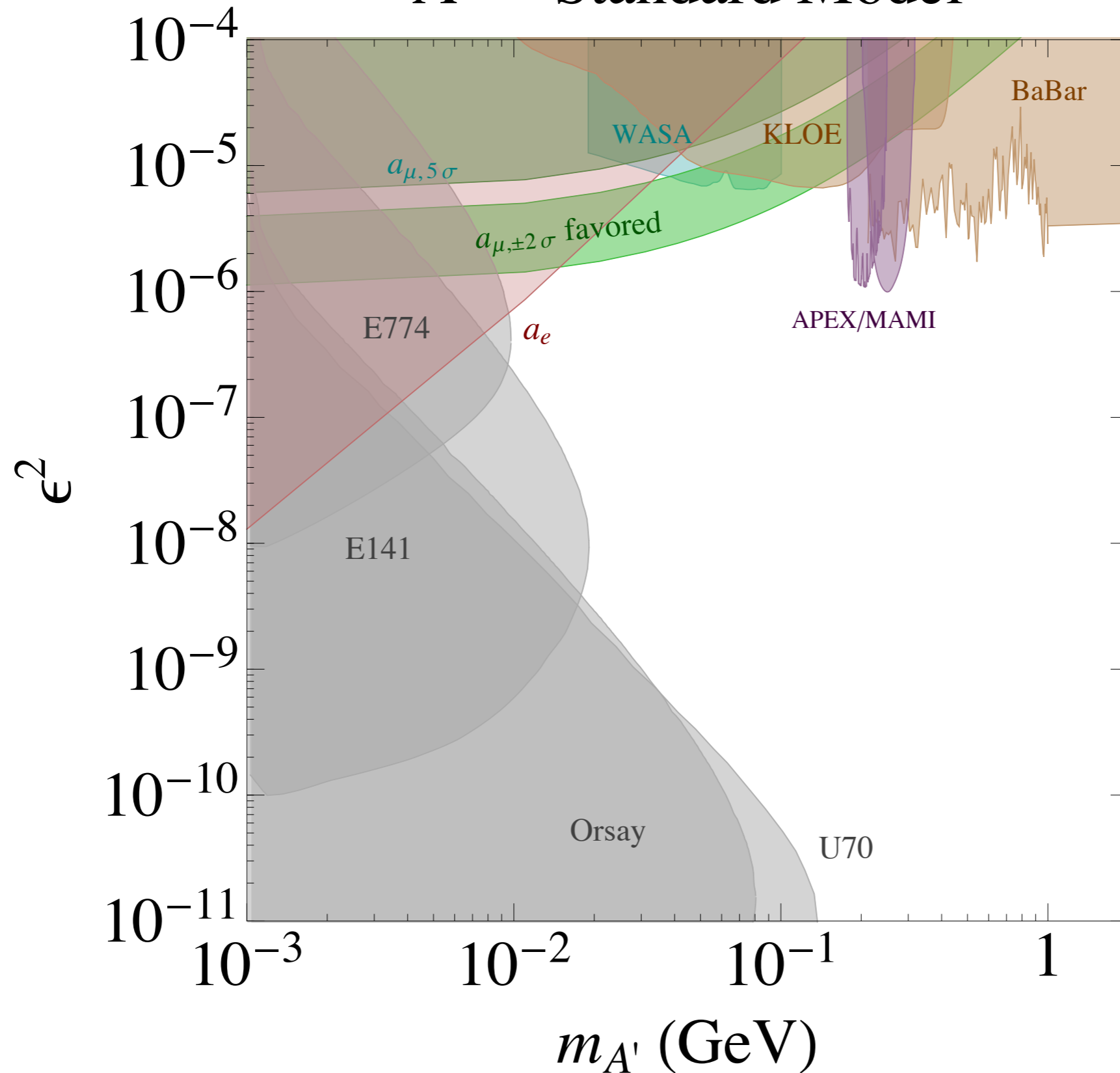
$A' \rightarrow$  Standard Model



dark photons  
considered well  
before 2008,  
but constraints  
never discussed in  
detail

# Status ~Today (published results)

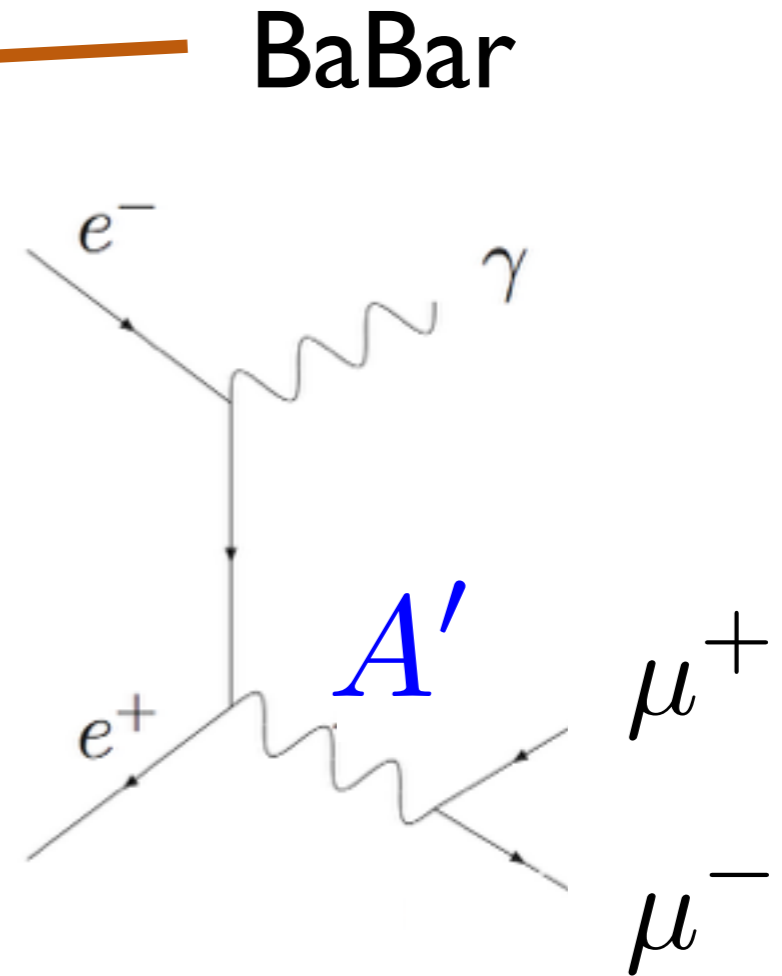
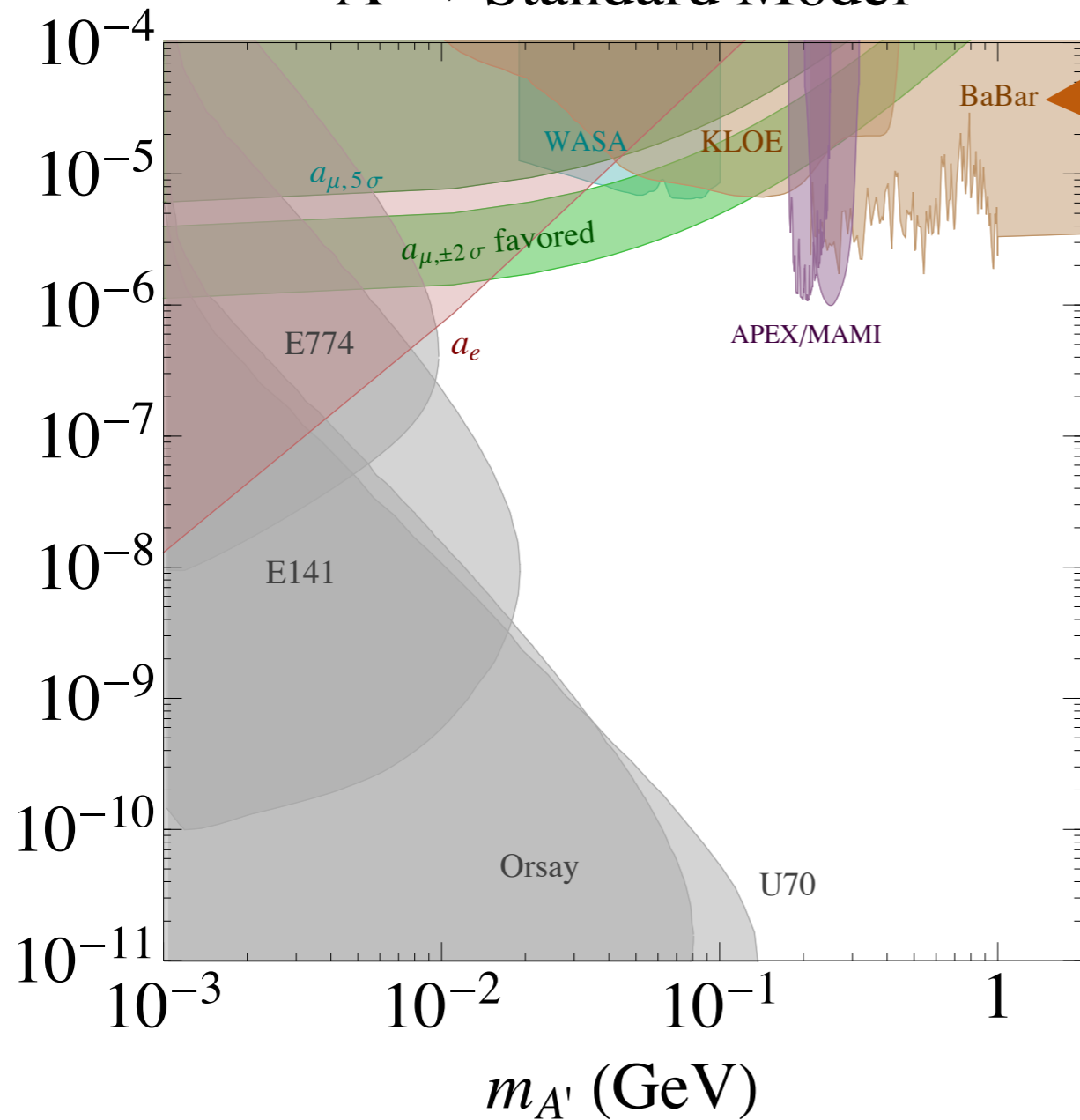
$A' \rightarrow$  Standard Model



(only showing strongest constraints) 5

## Re-interpretation by theorists of a BaBar analysis looking for pseudo-scalar decaying to $\mu^+\mu^-$

$A' \rightarrow$  Standard Model



# KLOE

2011, 2012

Use rare meson decays

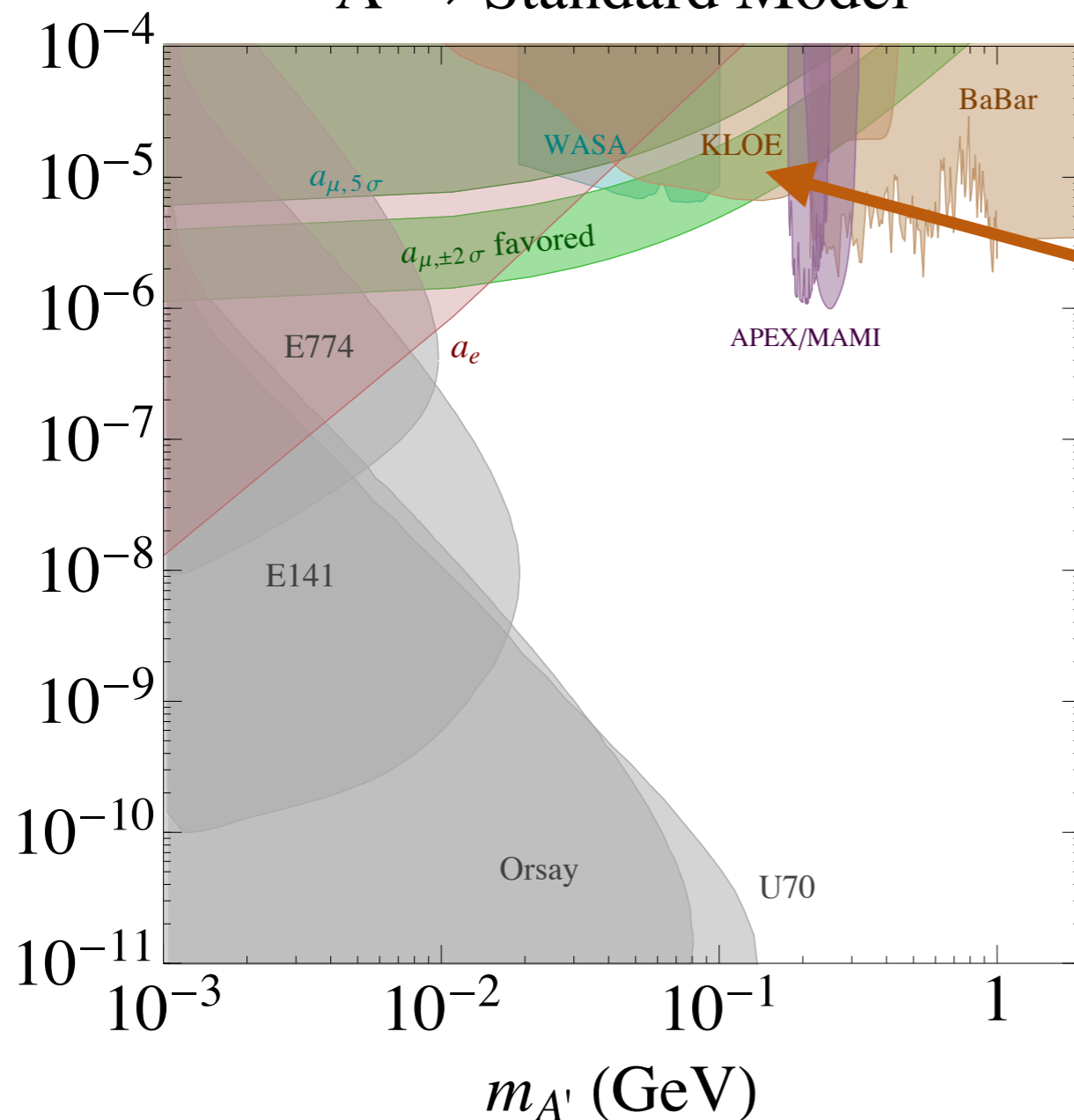
$$\phi \rightarrow \eta A'$$

$$A' \rightarrow e^+ e^-$$

$$\eta \rightarrow \pi^+ \pi^- \pi^0$$

$$\eta \rightarrow \pi^0 \pi^0 \pi^0$$

$A' \rightarrow$  Standard Model



KLOE

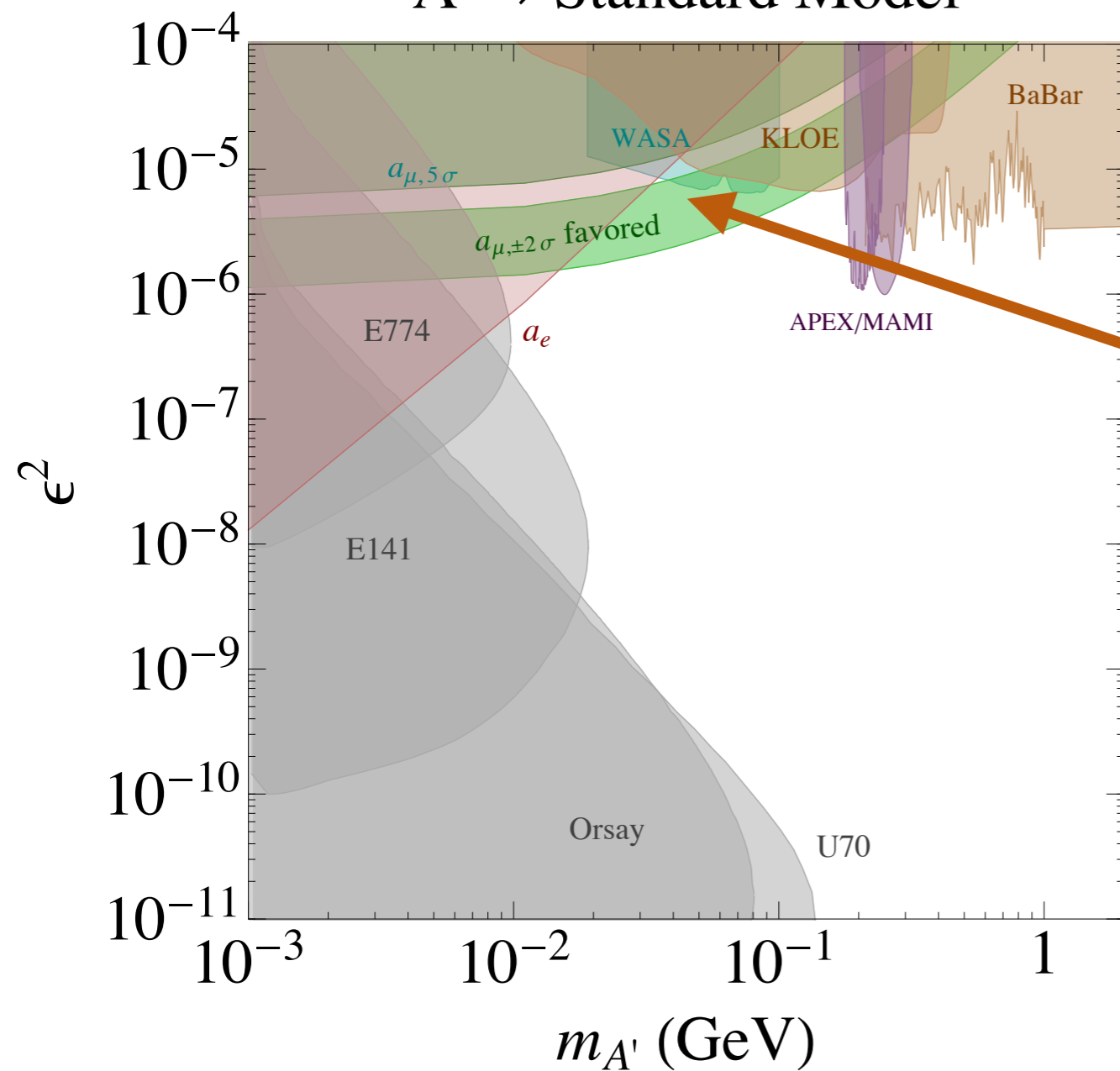
# WASA detector at COSY 2013

$$\pi^0 \rightarrow \gamma A'$$

$$A' \rightarrow e^+ e^-$$

$5 \times 10^5 \gamma e^+ e^-$  events

$A' \rightarrow$  Standard Model



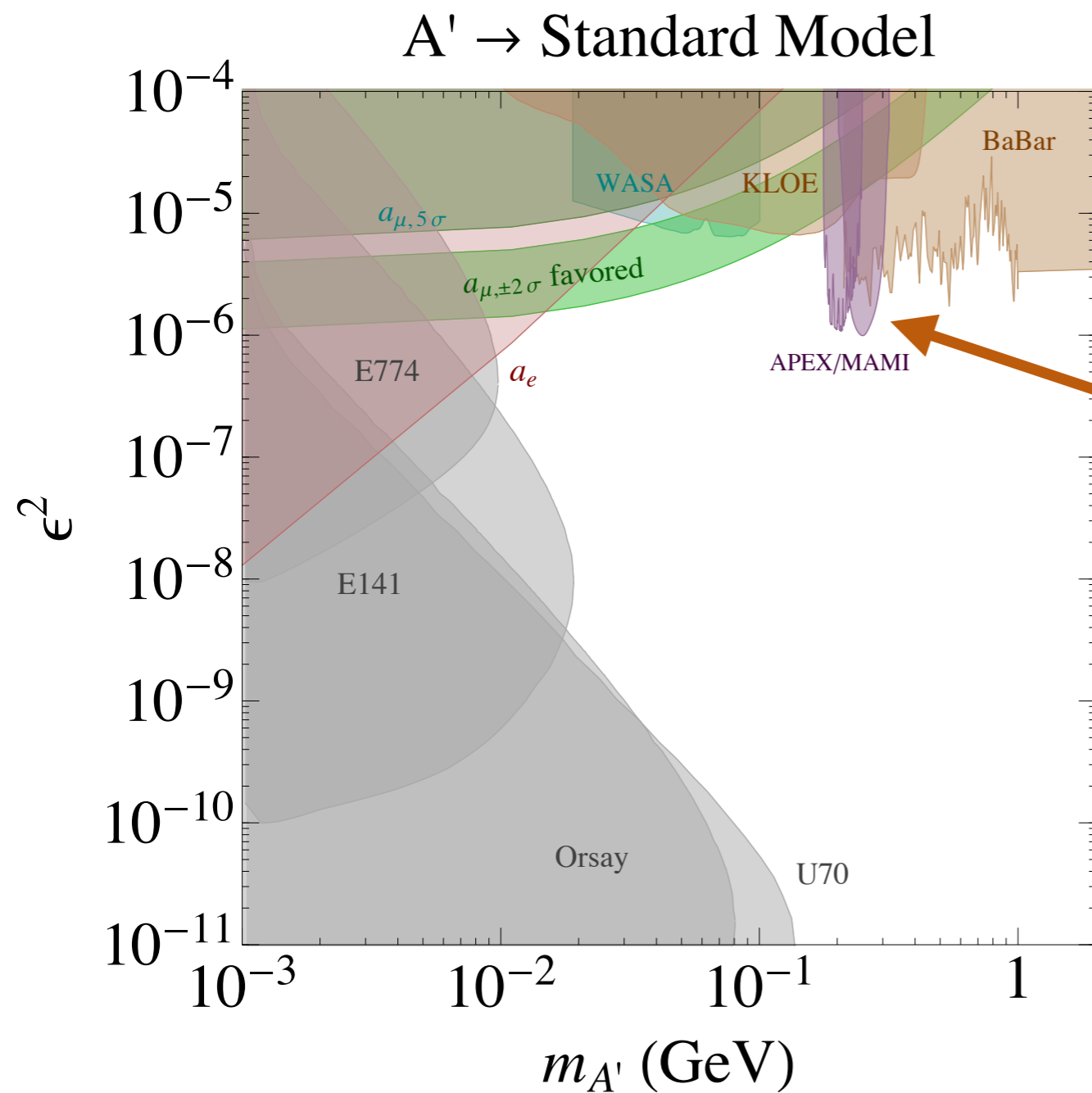
**WASA**



# APEX/MAMI

2011

based on test runs



**APEX/  
MAMI**

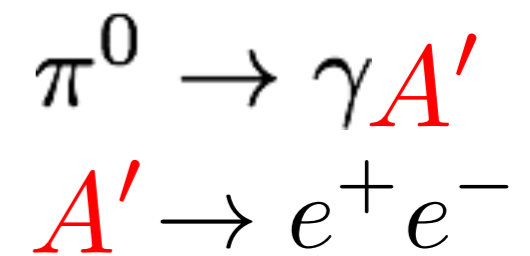
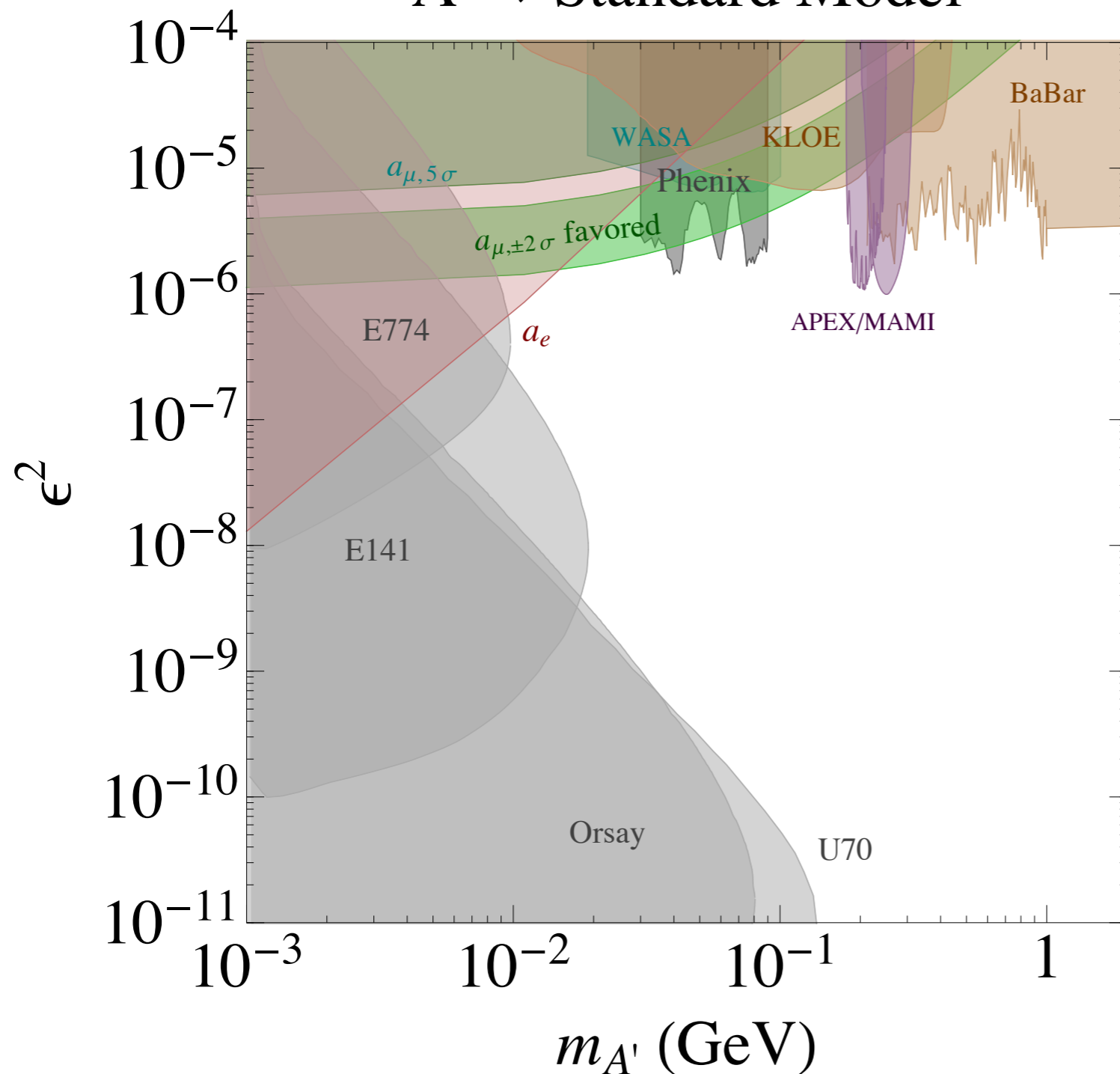
**Proof of  
Principle**

# PHENIX@RHIC (BNL)

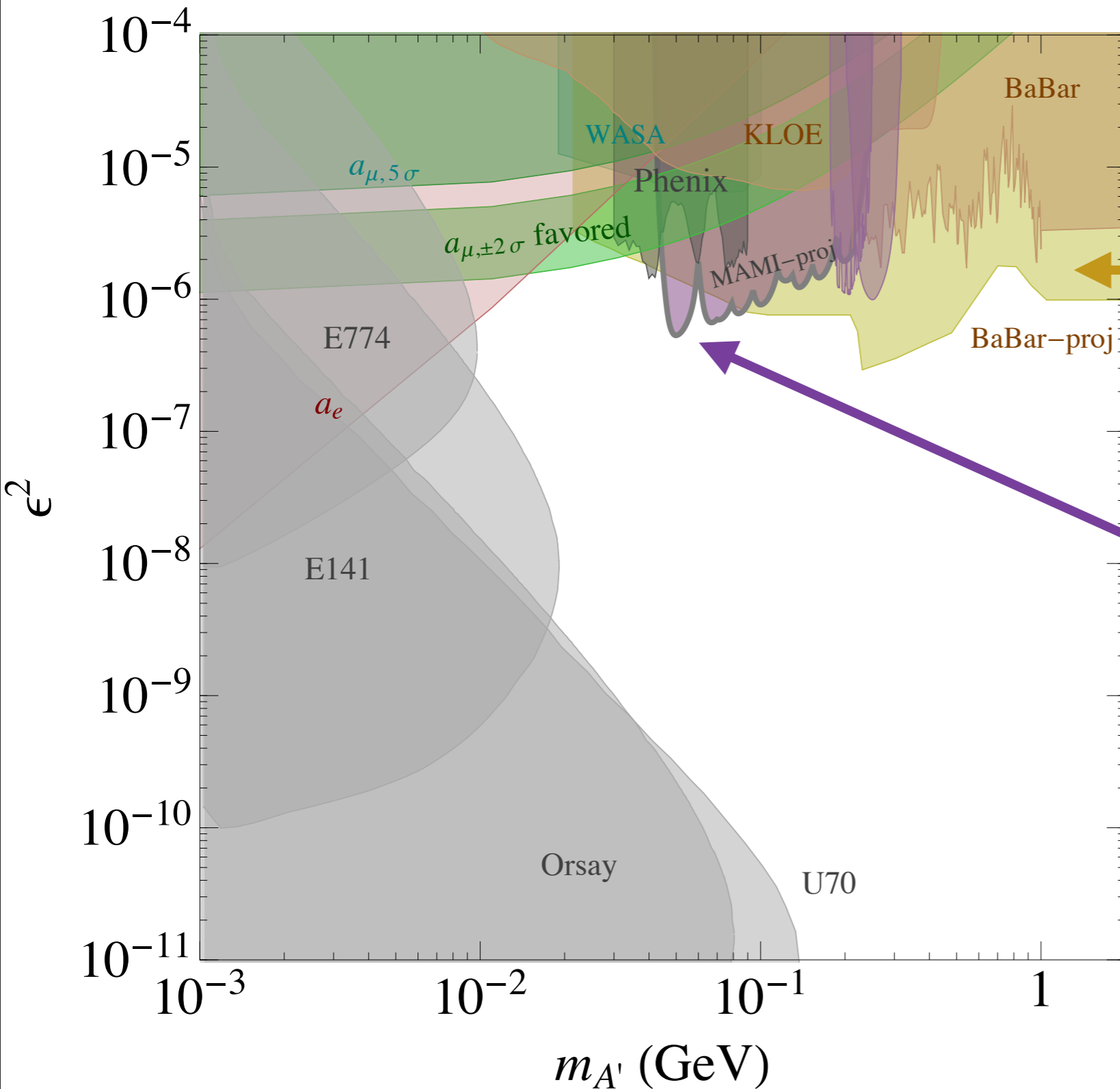
2013/14

(unpublished, presented in a talk)

$A' \rightarrow$  Standard Model



# Status ~soon?



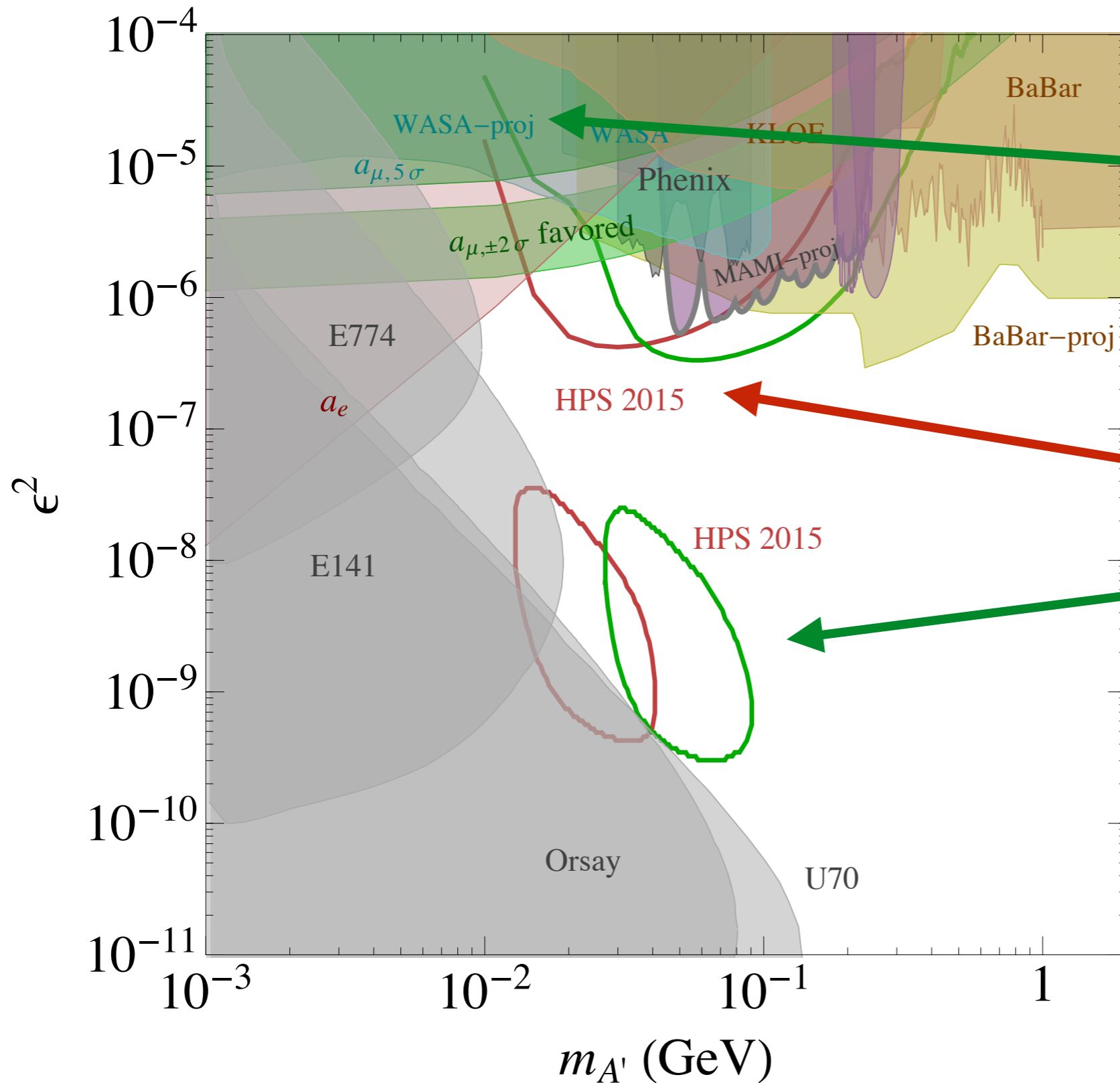
Existing data;  
analyses almost  
complete

BaBar  
(full dataset,  
other final states)

MAMI  
(more run  
settings)

*projections are rough;  
final results may differ!!!*

# Status ~2015?

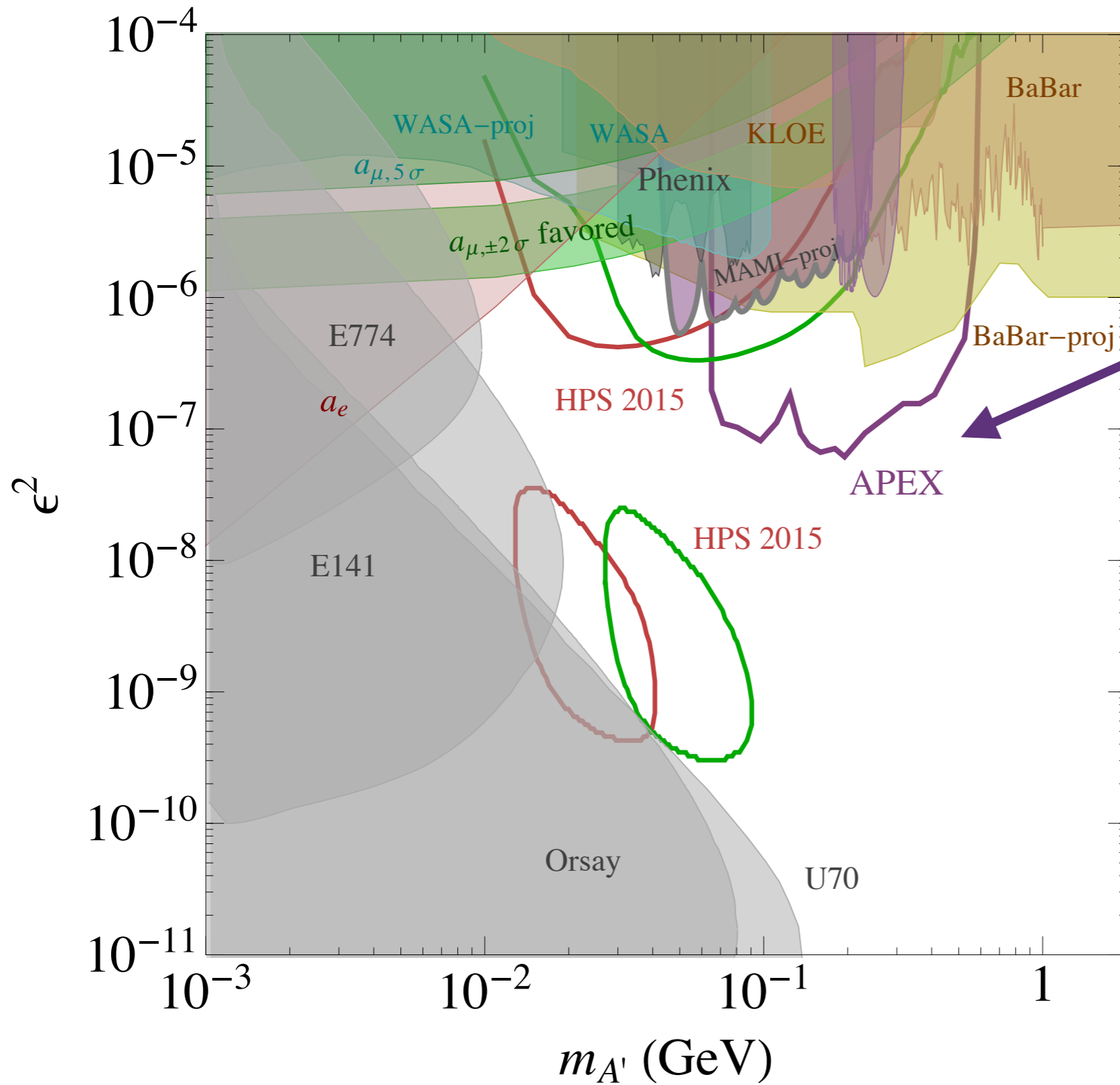


**WASA**  
projected run

**HPS's 2015**  
run in Hall B

*Run Plan still  
being determined  
i.e. curves  
may change!*

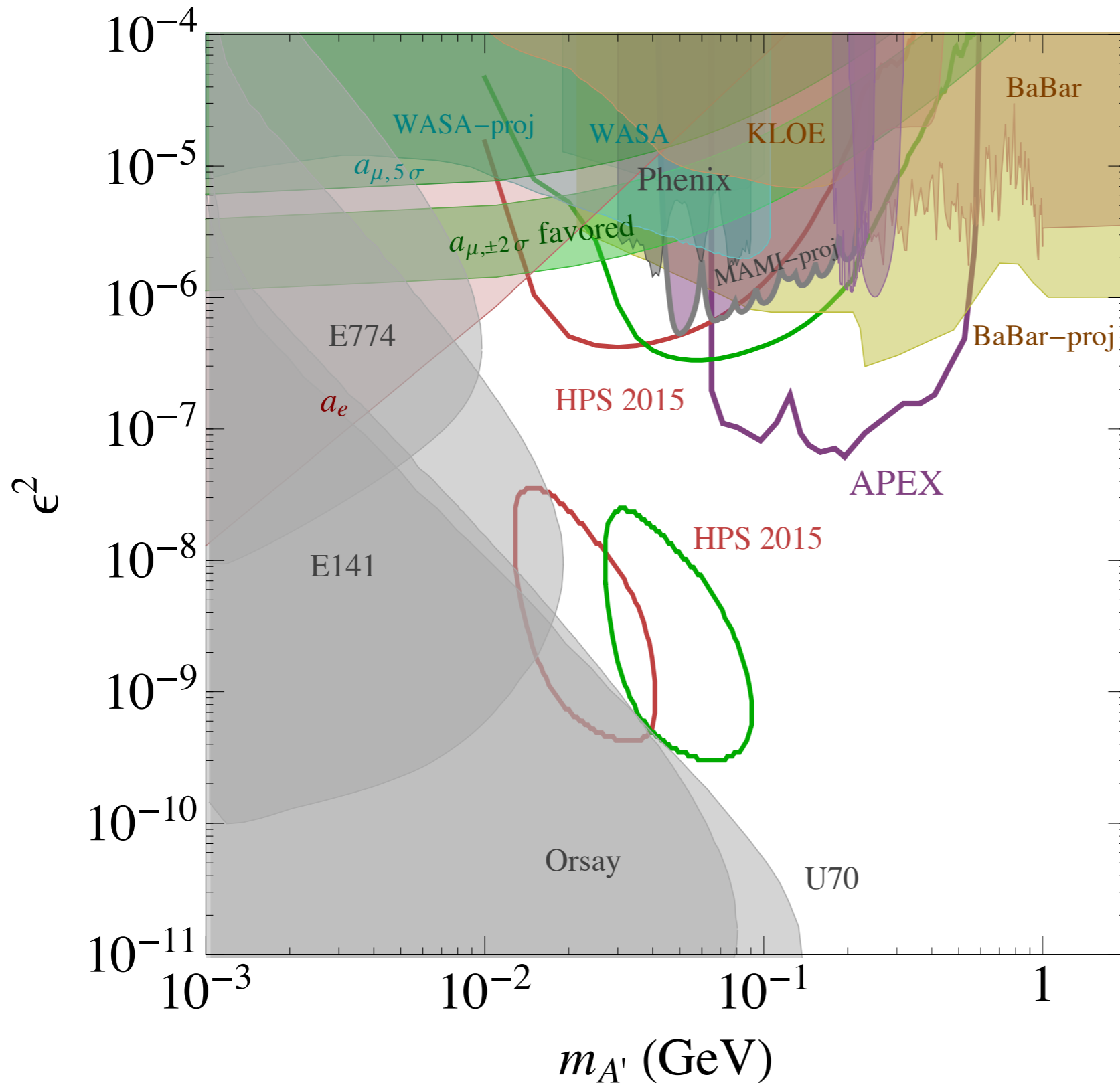
# APEX



APEX's  
projected  
full run

Will have  
significant  
new reach

# APEX



Unclear:  
more Phenix data?  
What are final  
MAMI and BaBar  
reach?  
CERN-SPS?

more results  
expected  
of course  
in 2016 and  
beyond

Field very active  
APEX has important role to play