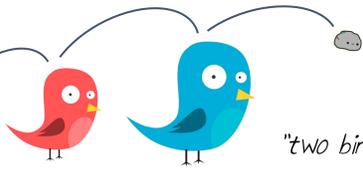


TAXO - towards an ultra-low background semiconductor detector for IAXO

Joanna Bilicki¹, Juan Francisco Castel Pablo², Frank Edzards¹, Esther Ferrer Ribas³, Susanne Mertens¹, Alfonso Ortiz de Solórzano², Lucinda Schönfeld¹, Juan Pablo Ulloa Beteta¹, Christoph Wiesinger¹(christoph.wiesinger@tum.de), Michael Willers¹

AXIONS



"two birds, one stone"

- solve **strong CP problem**, vanishing neutron electric dipole moment
- **dark matter candidate**, non-thermal production in early universe

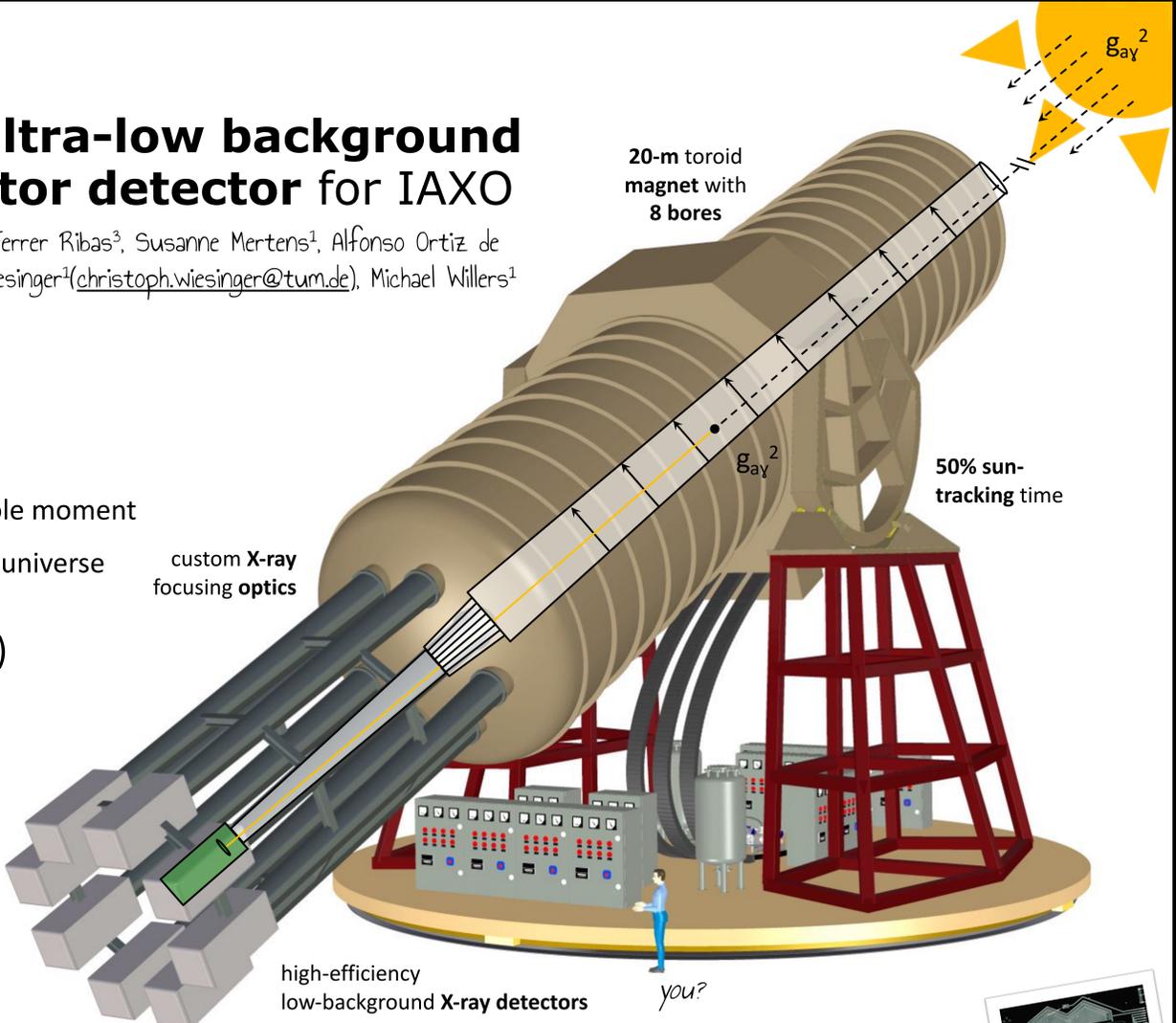
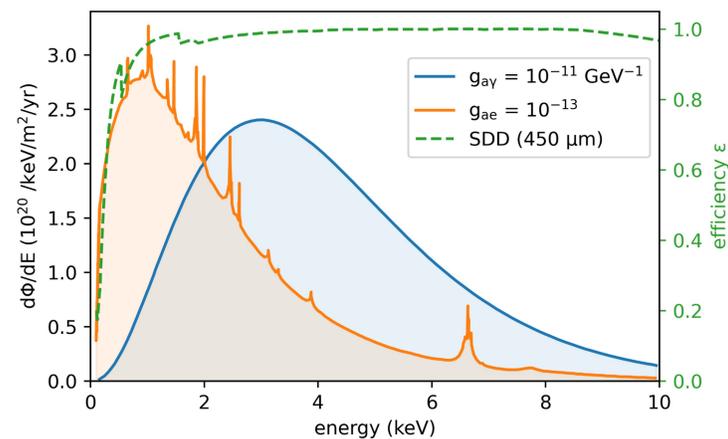
INTERNATIONAL AXION OBSERVATORY (IAXO)

[Armengaud et al., JINST 9 (2014) T05002]

- next generation axion **helioscope**
- **Primakoff conversion** of solar axions
- rare-event **X-ray detection** with

$< 10^{-8}$ cts / keV / cm² / s in [1,10] keV

"deep underground performance at shallow depth"

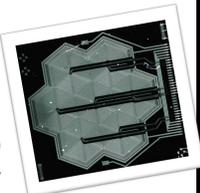


SILICON DRIFT DETECTOR (SDD)

[Lechner et al., NIM A 377 (1996) 346-351]

- $> 95\%$ **detection efficiency** for solar axion energies, **no entrance window**
- < 200 eV (FWHM) at 6 keV **energy resolution** (**ABC axion lines**), low energy threshold
- great, yet unverified potential for **low background** operation

SDD array



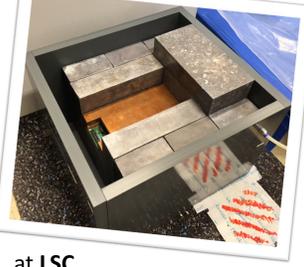
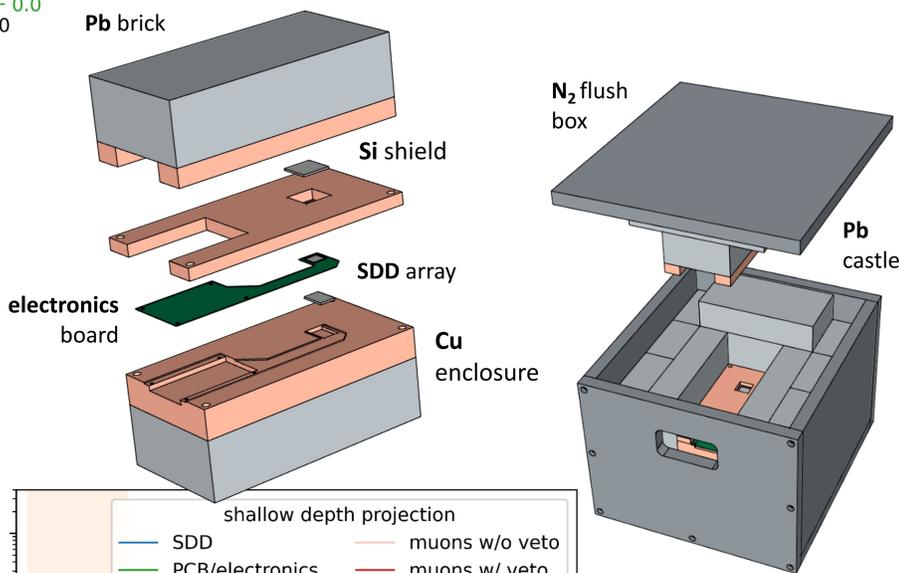
TAXO DEMONSTRATOR

"a giraffe in a box"

- TRISTAN prototype SDD with far electronics in **passive Si / Cu / Pb enclosure**

[Mertens et al., J.Phys.G 46 (2019) 6, 065203]

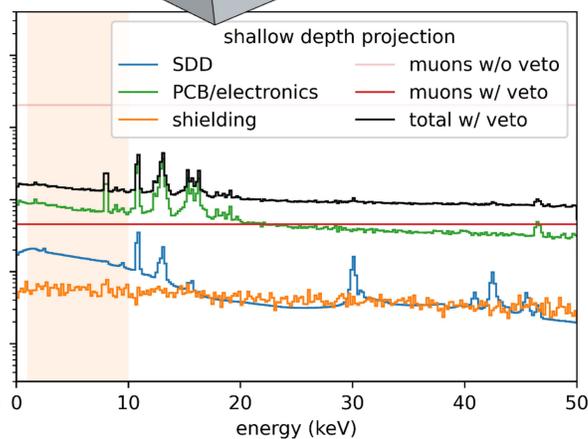
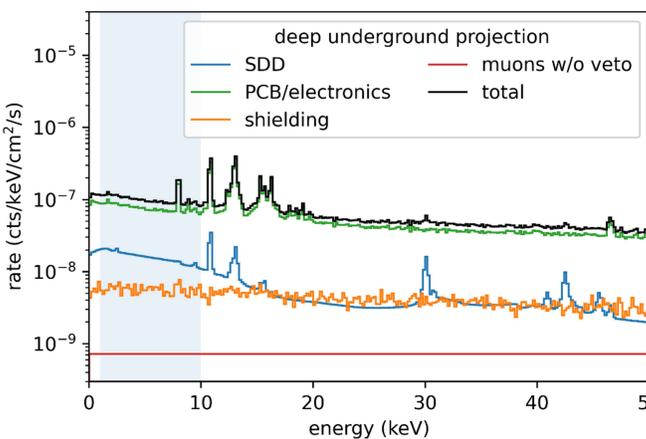
- at **Canfranc** underground laboratory (LSC) (2500 m.w.e.), test **intrinsic background**
- at TUM **shallow underground** laboratory, **muon veto** and neutron shield



at LSC

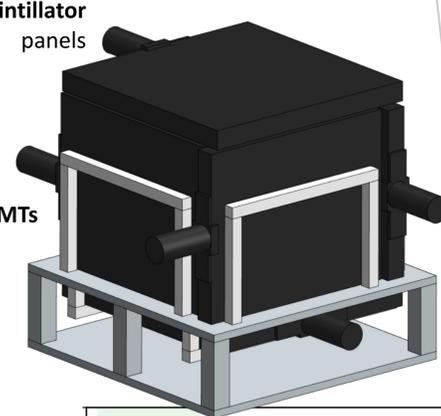


at TUM



scintillator panels

PMTs

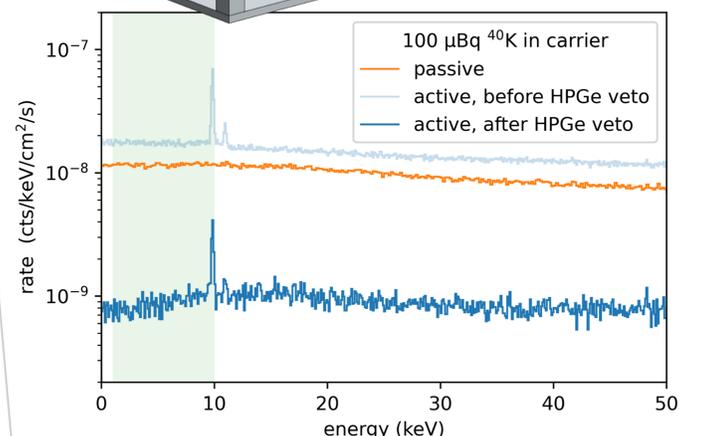
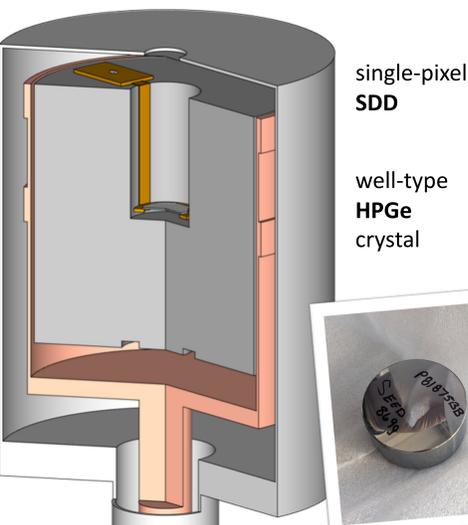


ALL-SEMICONDUCTOR ACTIVE-SHIELD DETECTOR

- single-pixel SDD in **well-type** high-purity germanium (**HPGe**) detector
- **background identification** with ultra-pure 4π veto, overcome IAXO background requirement
- synergies with **CEvNS**, **WIMP** and **$0\nu\beta\beta$ decay** rare-event search experiments

electronics

low-background cryostat



¹Technical University of Munich

²Universidad de Zaragoza,

³Université Paris-Saclay

