

# References for AxionLimits webpage

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## 1 Axion-photon

### Haloscopes

- ABRACADABRA [1, 2]
- ADMX [3, 4, 5, 6]
- ADMX-Sidecar [7, 8]
- ADMX-SLIC [9]
- CAPP [10, 11, 12, 13, 14, 15]
- CAST-CAPP [16]
- BASE [17]
- GrAHal [18]
- HAYSTAC [19, 20]
- ORGAN [21, 22]
- QUAX [23, 24, 25]
- RADES [26]
- RBF [27]
- SHAFT [28]
- TASEH [29]
- SuperMAG [30]
- UF [31]
- UPLOAD-DOWNLOAD [32]
- ABRACADABRA (projection) [33]
- ADBC (projection) [34]
- ADMX (projection) [35]
- aLIGO (projection) [36]
- ALPHA (projection) [37, 38]
- BRASS (projection) [39]
- BREAD (projection) [40]
- CADEx (projection) [41]
- DM-Radio (projection) [42, 43]
- DANCE (projection) [44]
- LAMPOST (projection) [45]
- MADMAX (projection) [46]
- FLASH (projection) [47, 48]
- QUAX (projection) [49]
- ORGAN (projection) [21]
- TOORAD (projection) [50]
- Twisted Anyon Cavity (projection) [51]
- WISPLC (projection) [52]
- SRF heterodyne cavity (projection) [53]

### LSW/Helioscopes

- ALPS [54]
- CAST [55, 56]
- CROWS [57]
- OSQAR [58]
- PVLAS [59]
- SAPPHIRES [60, 61]
- ALPS-II (projection) [62]
- IAXO (projection) [63]
- IAXO (Galactic SN) [64]

### Astro

- Betelgeuse [65]
- BICEP/KECK [66]
- Breakthrough Listen (Doppler shifted radio line in MW) [67]
- Breakthrough Listen (Neutron stars) [68]
- Bullet Cluster (archival radio data) [69]
- Cosmic IR background (hint) [70]
- Chandra (Hydra) [71]
- Chandra (M87) [72]
- Chandra (NG7 1275) [73]
- Chandra (H1821+643) [74]
- Chandra (Magnetic white dwarfs) [74]
- COBE/FIRAS+Planck spectral dist. [75]
- Diffuse SN ALPs [76] (see also [77])
- Distance ladder [78]
- Fermi-LAT (NGC 1275) [79]
- Fermi-LAT (Extragalactic SNe) [80]
- Fermi-LAT (Quasars) [81]
- Globular clusters ( $R$  parameter) [82]
- Globular clusters ( $R_2$  parameter) [83]
- HAWC (TeV Blazars) [84]
- HESS (PKS 2155-304) [85]
- INTEGRAL (ALP decay) [86]
- Leo T gas temperature [87]
- Magnetic white dwarf polarization [88]
- MOJAVE [89]
- Mrk 421 (ARGO-YBJ+Fermi): [90]
- Mrk 421 (ARGO-YBJ+MAGIC): [91]
- Neutron Stars (Foster et al.) [92]
- Neutron Stars (Darling) [93]
- Neutron Stars (Battye et al.) [94]
- Planck cosmic birefringence [95]
- PPTA+QUIJOTE [96]
- Pulsar polarisation arrays (projection) [97]
- Pulsar polar cap [98]
- Solar neutrinos [99]
- SN1987A- $\gamma$  [100]
- SN1987A- $\gamma$  (low mass ALPs) [101]
- SN1987A- $\gamma, \nu$  (high mass ALPs) [102]
- Low-energy supernovae (ALP decay) [103]
- Solar basin (NuSTAR) [104]
- Star clusters [105]
- SPT [106]
- Telescopes (Haystack) [107]
- Telescopes (MUSE) [108]
- Telescopes (VIMOS) [109]
- Telescopes (HST) [110]
- Fermi galactic SN (projection) [111]
- THESEUS (projection) [112]
- eROSITA (projection) [113]
- White dwarf initial-final mass relation [114]
- XMM-Newton (decaying DM ALPs) [115]

### Cosmology

- Ionisation fraction, EBL, X-rays [116]
- BBN+ $N_{\text{eff}}$  [117]
- Freeze in [118]

## 2 Axion-electron

- EDELWEISS [119]
- Magnon non-demolition [120]
- GERDA [121]
- LUX [122]
- Panda-X [123]
- SuperCDMS [124]
- XENON1T [125, 126]
- XENONnT [in prep.]
- XENON1T (Solar basin) [127]
- Red giants ( $\omega$ Cen) [128]
- Solar neutrinos [129]
- Magnons (projection) [130]
- Polaritons (projection) [131]
- DARWIN (projection) [132]
- LZ (projection) [133]
- QUAX [134, 135]
- Semiconductors (projection) [136]
- White dwarf hint [137]
- Freeze-in irreducible axions [118]
- X-rays (1-loop decay) [138]

## 3 Axion-nucleon

Note: CASPER and nEDM limits account for stochastic correction reported in [139]

- CASPER-ZULF-Comagnetometer [140]
- CASPER-ZULF-Sidechain [141]
- nEDM (ultracold neutrons and mercury) [142]
- NASDUCK [143, 144]
- PSI HgM [145]
- K-3He comagnetometer (fifth force) [146]
- K-3He comagnetometer (dark matter) [147]
- JEDI [148]
- Old comagnetometers [149]
- Torsion balance [150]
- Neutron star cooling [151] (corrected from [152])
- SN1987A Cooling [153]
- SNO (deuterium dissasociation) [154]
- Proton storage ring (projection) [155]
- DM comagnetometer (projection) [149]
- CASPER-wind (projection) [141]

## 4 Axion-EDM

- Beam EDM [156]
- CASPER-electric [157]
- nEDM [142]
- HfF<sup>+</sup> [158]
- JEDI [148]
- SN1987A [159]
- *Planck*+BAO thermal axion bound [160]
- CASPER-electric (projection) [161]
- Storage Ring EDM (projection) [161]

## 5 Axion mass versus $f_a$

- BBN [162]
- Beam EDM [156]
- Binary pulsars and Solar core constraint on  $\bar{\theta}$  [163]. I include minor numerical corrections made by [164, 165].
- GW170817 [166]
- HfF<sup>+</sup> [158]
- JEDI [148]
- nEDM [142]
- Piezoaxionic effect (projection) [167]
- SN1987A [159]
- Neutron stars (projection) [163].
- NS-NS and NS-BH Inspirals (projection) [163].
- White dwarfs [168]

## 6 Axion theory predictions

### 6.1 Post-inflation QCD axion

- Ballesteros et al. [169]
- Buschmann et al. 2020 [170]
- Buschmann et al. 2021 [171]
- Bonati et al. [172]
- Borsanyi et al. [173]
- Berkowitz et al. [174]
- Dine et al. [175]
- Petreczky et al. [176]
- Fleury & Moore [177]
- Klaer & Moore [178]

### 6.2 Other dark matter predictions

- ALP Cogenesis [179]
- Early matter domination [180]
- Post-inflation ALP misalignment [181]
- Trapped misalignment ( $\mathcal{Z}_{\mathcal{N}}$  axion) [164]

## 7 CP-violating couplings

Combined constraints [182]

### Scalar-nucleon

- Red giants [183]
- MICROSCOPE [184].
- Eot-Wash [185, 186, 187]
- Irvine [188]. Corrected to  $2\sigma$  limit by [189]
- HUST [190, 191, 192, 193].
- Stanford [194]
- IUPUI [195].
- Wuhan [189]

### Pseudoscalar-electron

- Red giants [183]
- Eot-wash [196]
- NIST [197]
- SMILE [198].
- QUAX [199, 200]
- Washington [201, 202].
- XENON1T [203]
- Magnon (projection) [131]
- QUAX (projection) [199].

### Pseudoscalar-nucleon

- Neutron star cooling [152]
- Washington [204]. Limit taken from [205].
- SMILE [198].
- Mainz [206]
- ARIADNE (projection) [207]
- CASPER-wind (projection) [161]
- DM comagnetometer (projection) [149]

## 8 Black hole superradiance

- Baryakhtar et al. [208] (just Stellar mass BHs)
- Mehta et al. [208] (Stellar mass and SMBHs)
- Stott [209]
- Ünal et al. [210] (Quasars)
- Cardoso et al. [211] (dark photon)

## 9 Dark photons

Combined constraints [212]

### SM photon-DP transitions

- Coulomb [213, 214, 215, 216, 217],
- Plimpton & Lawton's experiment [218, 217]
- Atomic spectroscopy [219]
- Atomic force microscopy (AFM) [217]
- Static magnetic field of the Earth [220, 221, 222]
- Static magnetic field of Jupiter [223, 222].
- ALPs [54]
- SPring-8 [224]
- UWA-LSW [225, 226]
- ADMX-LSW [227]
- CROWS [57].
- TEXONO [228]
- Crab nebula [229]
- COBE and FIRAS [230]

### Production in stars

- CAST [231]
- SHIP [232]
- HINODE [233]
- HB and RG stars [234]
- Neutron stars [235]
- Solar neutrinos [236]

### Dark matter cosmology/astro

- Arias et al. [181]
- Witte et al. [237, 238]
- Caputo et al. [239, 230],
- IGM [240],
- Leo T dwarf [241]
- Gas clouds [242]

### Dark matter experiments

- Reinterpreted axion limits [212]
- BREAD (projection) [40]
- DAMIC [243]
- Dark E-field Radio [244]
- DM Pathfinder [245]
- DOSUE-RR [246]
- FAST Radio antenna [247]
- FUNK [248]
- LAMPOST [249]
- MuDHI [250]
- ORGAN [251]
- ORPHEUS [252]
- QUALIPHIDE [253]
- Quantum cyclotron [254]
- SENSEI [255]
- SHUKET [256]
- SuperCDMS [257]
- SuperMAG [258, 259]
- SQuAD [260],
- SQMS [261],
- Tokyo dish antennae experiments [262, 263, 264]
- WISPDMS [265]
- XENON(100,1T,nT) [136, 203, 266, 267, 268, 269].

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