# 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]
- DANCE [17]
- BASE [18]
- GrAHal [19]
- HAYSTAC [20, 21, 22]
- ORGAN [23, 24]
- QUAX [25, 26, 27]
- RADES [28]
- RBF [29]
- SHAFT [30]
- TASEH [31]
- SuperMAG [32]
- UF [33]
- UPLOAD-DOWNLOAD [34, 35]
- ABRACADABRA (projection) [36]
- ADBC (projection) [37]
- ADMX (projection) [38]
- aLIGO (projection) [39]
- ALPHA (projection) [40, 41]
- BRASS (projection) [42]
- BREAD (projection) [43]
- CADEx (projection) [44]
- DALI (projection) [45]
- DM-Radio (projection) [46, 47]
- DANCE (projection) [48]
- LAMPOST (projection) [49]
- MADMAX (projection) [50]
- FLASH (projection) [51, 52]
- QUAX (projection) [53]
- ORGAN (projection) [23]
- TOORAD (projection) [54]
- Twisted Anyon Cavity (projection) [55]
- WISPLC (projection) [56]
- SRF heterodyne cavity (projection) [57]

### LSW/Helioscopes

- ALPS [58]
- CAST [59, 60]
- CROWS [61]
- OSQAR [62]
- PVLAS [63]
- SAPPHIRES [64, 65]
- ALPS-II (projection) [66]
- IAXO (projection) [67]
- IAXO (Galactic SN) [68]

### Astro

- Axion star explosions [69]
- Betelgeuse [70]
- BICEP/KECK [71]
- Breakthrough Listen (Doppler shifted radio line in MW) [72]
- Bullet Cluster (archival radio data) [73]
- Cosmic IR background (hint) [74]
- Chandra (Hydra) [75]
- Chandra (M87) [76]
- Chandra (NG7 1275) [77]
- Chandra (H1821+643) [78]
- CMB Anisotropies [79, 80]
- COBE/FIRAS+Planck spectral dist. [81]
- Diffuse gamma-rays [82]
- Diffuse SN ALPs [83] (see also [84])
- Distance ladder [85]
- Fermi-LAT (NGC 1275) [86]
- Fermi-LAT (Extragalactic SNe) [87]
- Fermi-LAT (Quasars) [88]
- Gamma-ray attenuation (ALP dark matter) [89]
- Globular clusters ($R$ parameter) [90]
- Globular clusters ($R_2$ parameter) [91]
- HAWC (TeV Blazars) [92]
- HESS (PKS 2155-304) [93]
- INTEGRAL (ALP decay) [94]
- Leo T gas temperature [95]
- Magnetic white dwarfs (X-rays) [96]
- Magnetic white dwarf (polarization) [97]
- MOJAVE [98]
- Mrk 421 (ARGO-YBJ+Fermi): [99]
- Mrk 421 (ARGO-YBJ+MAGIC): [100]
- Neutron Stars (Foster et al. 2020) [101]
- Neutron Stars (Darling 2020) [102]
- Neutron Stars (Battye et al. 2021) [103]
- Neutron stars (Foster et al. 2022) [104]
- Neutron Stars (Battye et al. 2023) [105]
- NuSTAR (decaying dark matter, recast from Sterile nu) [106, 107, 108]
- Planck cosmic birefringence [109]
- POLARBEAR [110]
- PPTA+QUIJOTE [111]
- Pulsar polarisation arrays (projection) [112]
- Pulsar polar cap [113]
- Red supergiant [114]
- Solar neutrinos [115]
- SN1987A-$\gamma$ (ALP decay) [116, 117]
- SN1987A-$\gamma$ (low mass ALP conversion) [118, 117]
- SN1987A-$\gamma$,$\nu$ (high mass ALPs) [119]
- Low-energy supernovae (ALP decay) [82]
- Solar basin (NuSTAR) [120]
- Solar basin (NuSTAR and SPHINX) [121]
- Star clusters [122]
- SPT [123]
- Telescopes (Haystack) [124]
- Telescopes (MUSE) [125]
- Telescopes (VIMOS) [126]
- Telescopes (HST) [127, 128]
- Fermi galactic SN (projection) [129]
- THESEUS (projection) [130]
- eROSITA (projection) [131]
- White dwarf initial-final mass relation [132]
- XMM-Newton (decaying DM ALPs) [133]

### Cosmology

- Ionisation fraction, EBL, X-rays [134]
- BBN+$N_{\rm eff}$ [135]
- Freeze in [136]

## 2 Heavy ALP-photon coupling

- ATALS (PbPb) [137]
- BaBar [138]
- Beam dump [139, 140, 138, 141, 142]
- Belle II [143]
- BESIII [144]
- CMS (PbPb) [145]
- LEP [146]
- LHC (pp)[147]
- NOMAD [148]
- OPAL [147]
- PrimEx [149, 150]
- CONUS (projection) [151]
- DUNE (projection) [152]
- FASER LLP (projection) [153]

## 3 Axion-electron

- EDELWEISS [154]
- Magnon non-demolition [155]
- DarkSide-50 [156]
- GERDA [157]
- LUX [158]
- Panda-X [159]
- SuperCDMS [160]
- XENON1T [161, 162]
- XENONnT [163]
- XENON1T (Solar basin) [164]
- Red giants ($\omega$Cen) [165]
- NV Centers (projection) [166]
- Solar neutrinos [167]
- Magnons (projection) [168]
- Polaritons (projection) [169]
- DARWIN (projection) [170]
- LZ (projection) [171]
- QUAX [172, 173]
- Semiconductors (projection) [174]
- White dwarf hint [175]
- Freeze-in irreducible axions [136]
- X-rays (1-loop decay) [176]

## 4 Axion-nucleon

Note: CASPEr and nEDM limits account for stochastic correction reported in [177]

- Casimir effect (fifth force) [178]
- CASPEr-ZULF-Comagnetometer [179]
- CASPEr-ZULF-Sidechain [180]
- nEDM (ultracold neutrons and mercury) [181]
- NASDUCK [182, 183]
- PSI HgM (nEDM) [184]
- K-3He comagnetometer (fifth force) [185]
- K-3He comagnetometer (dark matter) [186]
- JEDI [187]
- Old comagnetometers [188]
- Torsion balance [189]
- Neutron star cooling [190] (corrected from [191])
- SN1987A Cooling [192]
- SNO (deuterium dissasociation) [193]
- Proton storage ring (projection) [194]
- DM comagnetometer (projection) [188]
- CASPEr-gradient (projection) [180]
- Superfluid helium-3 HPD (projection) [195]

## 5 Axion-EDM

- Axinovae [196]
- Beam EDM [197]
- BBN (dark matter) [198]
- CASPEr-electric [199]
- nEDM [181]
- HfF$^+$ [200]
- JEDI [187]
- Rb/Quartz [201]
- SN1987A [202]
- *Planck*+BAO thermal axion bound [203]
- CASPEr-electric (projection) [204]
- Storage Ring EDM (projection) [204]

## 6 Axion mass versus $f_a$

- BBN (dark matter) [198]
- Beam EDM [197]
- Binary pulsars and Solar core constraint on $\bar{\theta}$ [205]. I include minor numerical corrections made by [206, 207].
- GW170817 [208]
- HfF$^+$ [200]
- Rb/Quartz [201]
- JEDI [187]
- nEDM [181]
- Piezoaxionic effect (projection) [209]
- *Planck*+BAO thermal axion bound [203]
- SN1987A [202]
- Neutron stars (projection) [205].
- NS-NS and NS-BH Inspirals (projection) [205].
- White dwarfs [210]

### 6.1 Black hole superradiance

- Baryakhtar et al. [211] (just Stellar mass BHs)
- Mehta et al. [211] (Stellar mass and SMBHs)
- Stott [212]
- Ünal et al. [213] (Quasars)
- Cardoso et al. [214] (dark photon)

## 7 Axion theory predictions

### 7.1 Post-inflation QCD axion

- Ballesteros et al. [215]
- Buschmann et al. 2020 [216]
- Buschmann et al. 2021 [217]
- Bonati et al. [218]
- Borsanyi et al. [219]
- Berkowitz et al. [220]
- Dine et al. [221]
- Petreczky et al. [222]
- Fleury & Moore [223]
- Klaer & Moore [224]
- Gorghetto et al. [225]
- Saikawa et al. [67]

### 7.2 Other dark matter predictions

- ALP Cogenesis [226]
- Early matter domination [227]
- Post-inflation ALP misalignment [228, 229]
- Trapped misalignment ($\mathcal{Z}_\mathcal{N}$ axion) [206]

## 8 CP-violating couplings

Combined constraints [230]

### Scalar-nucleon

- Red giants [231]
- MICROSCOPE [232].
- Eot-Wash [233, 234, 235]
- Irvine [236]. Corrected to $2\sigma$ limit by [237]
- HUST [238, 239, 240, 241].
- Stanford [242]
- IUPUI [243].
- Wuhan [237]

### Pseudoscalar-electron

- Red giants [231]
- Eot-wash [244]
- NIST [245]
- SMILE [246].
- QUAX [247, 248, 249]
- Washington [250, 251].
- XENON1T [252]
- Magnon (projection) [169]
- QUAX (projection) [247].

### Pseudoscalar-nucleon

- Neutron star cooling [190]
- Hefei (Earth) [253]
- Hefei (mm) [254]
- Washington [255]. Limit taken from [256].
- SMILE [246].
- Mainz [257]
- Moon/Sun [258]
- ARIADNE (projection) [259]
- CASPEr-wind (projection) [204]
- DM comagnetometer (projection) [188]
- Fifth force Ne-Rb-K comagnetometer (projection) [260]

## 9 Scalars

### Scalar-photon

- Globular clusters [91]
- Eot-Wash (EP) [261]
- Fifth force [262, 263, 264, 265]
- MICROSCOPE [232]
- AURIGA [266]
- BACON [267]
- Cs/Cav [268]
- DAMNED [269]
- Dy/Dy [270]
- Dy/Quartz [201]
- Dynamic Decoupling [271]
- GEO600 [272]
- LIGO O3 [273]
- Holometer [274]
- H/Quartz/Sapphire [275]
- PTB (Yb+, Sr clock) [276]
- $I_2$ [277]
- Rb/Cs [278]
- Sr/Si [279]
- Yb/Sr [280]
- AEDGE (projection) [281]
- AION (projection) [281]
- DUAL (projection) [282]
- MAGIS (projection) [283]
- Nuclear clock (projection) [284]
- Mechanical Resonators (projection) [285]

### Scalar-electron

- Red giants [231]
- White dwarfs [286]
- Eot-Wash (EP) [261]
- Fifth force [262, 263, 264, 265]
- MICROSCOPE [232]
- AURIGA [266]
- Cs/Cav [268]
- DAMNED [269]
- GEO600 [272]
- Holometer [274]
- H/Quartz/Sapphire [275]
- $I_2$ [277]
- H/Si [279]
- Rb/Quartz [201]
- Yb/Cs [287]
- LIGO O3 [273]
- FOCOS (nuclear clock projection) [288]
- AEDGE (projection) [281]
- AION (projection) [281]
- DUAL (projection) [282]
- Optical microwave clock (projection) [289]
- Optical cavities [290]
- SrOH [291]
- Mechanical Resonators (projection) [285]
- IPTA (mock data) [292]

## 10 Vectors

### B-L coupling

- Casimir [293, 294, 295]
- Eot-Wash (EP) [296]
- Eot-Wash (ISL) [297]
- MICROSCOPE [298]
- DM stability [299]
- Horizontal branch [231]
- Sun [231]
- Eot-Wash (DM) [300]
- LIGO (O1) [301]
- LIGO/VIRGO [301]
- Asteroids (projection) [302]
- LISA (projection) [302]
- MAGIS (projection) [283]
- Optomechanical membranes (projection) [303]
- SKA (projection) [304]
- Torsion balance (projection) [304]
- STE-QUEST (projection) [305]

## 11 Dark photons

Combined constraints [306]

### SM photon-DP transitions

- Coulomb [307, 308, 309, 310, 311],
- Plimpton & Lawton's experiment [312, 311]
- Atomic spectroscopy [313]
- Atomic force microscopy (AFM) [311]
- Static magnetic field of the Earth [314, 315, 316]
- Static magnetic field of Jupiter [317, 316].
- ALPs [58]
- ALPS-II (projection) [318]
- SPring-8 [319]
- UWA-LSW [320, 321]
- ADMX-LSW [322]
- CROWS [61].
- DarkSRF [323]
- DarkSRF (projection) [324]
- TEXONO [325]
- Crab nebula [326]
- COBE and FIRAS [327]
- STAX (projection) [328]

### Production in stars

- CAST [329]
- SHIPS [330]
- HINODE [331]
- HB and RG stars [332]
- Neutron stars [333]
- Solar neutrinos [334]
- XENON1T [335]

### Dark matter cosmology/astro

- Arias et al. [228]
- Witte et al. [336, 337]
- Caputo et al. [338, 327],
- IGM [339],
- Leo T dwarf [340]
- Gas clouds [341]

### Dark matter experiments

- Reinterpreted axion limits [306]
- ALPHA [41]
- BREAD (projection) [43]
- DarkSide-50 [156]
- DAMIC [342]
- Dark E-field Radio [343]
- DM Pathfinder [344]
- DOSUE-RR [345]
- FAST Radio antenna [346]
- FUNK [347]
- LAMPOST [348]
- LOFAR (solar corona) [349]
- MuDHI [350]
- ORGAN [351]
- ORPHEUS [352]
- QUALIPHIDE [353]
- Quantum cyclotron [354]
- SENSEI [355]
- SHUKET [356]
- SuperCDMS [357]
- SuperMAG [358, 359]
- SQuAD [360],
- SQMS [361],
- Tokyo dish antennae experiments [362, 363, 364]
- WISPDMX [365]
- XENON(100,1T,nT) [174, 252, 366, 367, 335, 368].

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