# 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]
- DM-Radio (projection) [45, 46]
- DANCE (projection) [47]
- LAMPOST (projection) [48]
- MADMAX (projection) [49]
- FLASH (projection) [50, 51]
- QUAX (projection) [52]
- ORGAN (projection) [23]
- TOORAD (projection) [53]
- Twisted Anyon Cavity (projection) [54]
- WISPLC (projection) [55]
- SRF heterodyne cavity (projection) [56]

### LSW/Helioscopes

- ALPS [57]
- CAST [58, 59]
- CROWS [60]
- OSQAR [61]
- PVLAS [62]
- SAPPHIRES [63, 64]
- ALPS-II (projection) [65]
- IAXO (projection) [66]
- IAXO (Galactic SN) [67]

### Astro

- Axion star explosions [68]
- Betelgeuse [69]
- BICEP/KECK [70]
- Breakthrough Listen (Doppler shifted radio line in MW) [71]
- Breakthrough Listen (Neutron stars) [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]
- COBE/FIRAS+Planck spectral dist. [79]
- Diffuse gamma-rays [80]
- Diffuse SN ALPs [81] (see also [82])
- Distance ladder [83]
- Fermi-LAT (NGC 1275) [84]
- Fermi-LAT (Extragalactic SNe) [85]
- Fermi-LAT (Quasars) [86]
- Gamma-ray attenuation (ALP dark matter) [87]
- Globular clusters ($R$ parameter) [88]
- Globular clusters ($R_2$ parameter) [89]
- HAWC (TeV Blazars) [90]
- HESS (PKS 2155-304) [91]
- INTEGRAL (ALP decay) [92]
- Leo T gas temperature [93]
- Magnetic white dwarfs (X-rays) [94]
- Magnetic white dwarf (polarization) [95]
- MOJAVE [96]
- Mrk 421 (ARGO-YBJ+Fermi): [97]
- Mrk 421 (ARGO-YBJ+MAGIC): [98]
- Neutron Stars (Foster et al.) [99]
- Neutron Stars (Darling) [100]
- Neutron Stars (Battye et al.) [101]
- Planck cosmic birefringence [102]
- PPTA+QUIJOTE [103]
- Pulsar polarisation arrays (projection) [104]
- Pulsar polar cap [105]
- Red supergiant [106]
- Solar neutrinos [107]
- SN1987A-$\gamma$ (ALP decay) [108, 109]
- SN1987A-$\gamma$ (low mass ALP conversion) [110, 109]
- SN1987A-$\gamma$,$\nu$ (high mass ALPs) [111]
- Low-energy supernovae (ALP decay) [80]
- Solar basin (NuSTAR) [112]
- Star clusters [113]
- SPT [114]
- Telescopes (Haystack) [115]
- Telescopes (MUSE) [116]
- Telescopes (VIMOS) [117]
- Telescopes (HST) [118, 119]
- Fermi galactic SN (projection) [120]
- THESEUS (projection) [121]
- eROSITA (projection) [122]
- White dwarf initial-final mass relation [123]
- XMM-Newton (decaying DM ALPs) [124]

### Cosmology

- Ionisation fraction, EBL, X-rays [125]
- BBN+$N_{\rm eff}$ [126]
- Freeze in [127]

## 2 Heavy ALP-photon coupling

- ATALS (PbPb) [128]
- BaBar [129]
- Beam dump [130, 131, 129, 132, 133]
- Belle II [134]
- BESIII [135]
- CMS (PbPb) [136]
- LEP [137]
- LHC (pp)[138]
- NOMAD [139]
- OPAL [138]
- PrimEx [140, 141]
- CONUS (projection) [142]
- DUNE (projection) [143]
- FASER LLP (projection) [144]

## 3 Axion-electron

- EDELWEISS [145]
- Magnon non-demolition [146]
- GERDA [147]
- LUX [148]
- Panda-X [149]
- SuperCDMS [150]
- XENON1T [151, 152]
- XENONnT [153]
- XENON1T (Solar basin) [154]
- Red giants ($\omega$Cen) [155]
- NV Centers (projection) [156]
- Solar neutrinos [157]
- Magnons (projection) [158]
- Polaritons (projection) [159]
- DARWIN (projection) [160]
- LZ (projection) [161]
- QUAX [162, 163]
- Semiconductors (projection) [164]
- White dwarf hint [165]
- Freeze-in irreducible axions [127]
- X-rays (1-loop decay) [166]

## 4 Axion-nucleon

Note: CASPEr and nEDM limits account for stochastic correction reported in [167]

- Casimir effect (fifth force) [168]
- CASPEr-ZULF-Comagnetometer [169]
- CASPEr-ZULF-Sidechain [170]
- nEDM (ultracold neutrons and mercury) [171]
- NASDUCK [172, 173]
- PSI HgM (nEDM) [174]
- K-3He comagnetometer (fifth force) [175]
- K-3He comagnetometer (dark matter) [176]
- JEDI [177]
- Old comagnetometers [178]
- Torsion balance [179]
- Neutron star cooling [180] (corrected from [181])
- SN1987A Cooling [182]
- SNO (deuterium dissasociation) [183]
- Proton storage ring (projection) [184]
- DM comagnetometer (projection) [178]
- CASPEr-gradient (projection) [170]
- Superfluid helium-3 HPD (projection) [185]

## 5 Axion-EDM

- Beam EDM [186]
- BBN (dark matter) [187]
- CASPEr-electric [188]
- nEDM [171]
- $HfF^+$ [189]
- JEDI [177]
- Rb/Quartz [190]
- SN1987A [191]
- *Planck*+BAO thermal axion bound [192]
- CASPEr-electric (projection) [193]
- Storage Ring EDM (projection) [193]

## 6 Axion mass versus $f_a$

- BBN (dark matter) [187]
- Beam EDM [186]
- Binary pulsars and Solar core constraint on $\bar{\theta}$ [194]. I include minor numerical corrections made by [195, 196].
- GW170817 [197]
- $HfF^+$ [189]
- Rb/Quartz [190]
- JEDI [177]
- nEDM [171]
- Piezoaxionic effect (projection) [198]
- *Planck*+BAO thermal axion bound [192]
- SN1987A [191]
- Neutron stars (projection) [194].
- NS-NS and NS-BH Inspirals (projection) [194].
- White dwarfs [199]

### 6.1 Black hole superradiance

- Baryakhtar et al. [200] (just Stellar mass BHs)
- Mehta et al. [200] (Stellar mass and SMBHs)
- Stott [201]
- Ünal et al. [202] (Quasars)
- Cardoso et al. [203] (dark photon)

## 7 Axion theory predictions

### 7.1 Post-inflation QCD axion

- Ballesteros et al. [204]
- Buschmann et al. 2020 [205]
- Buschmann et al. 2021 [206]
- Bonati et al. [207]
- Borsanyi et al. [208]
- Berkowitz et al. [209]
- Dine et al. [210]
- Petreczky et al. [211]
- Fleury & Moore [212]
- Klaer & Moore [213]
- Gorghetto et al. [214]
- Saikawa et al. [66]

### 7.2 Other dark matter predictions

- ALP Cogenesis [215]
- Early matter domination [216]
- Post-inflation ALP misalignment [217, 218]
- Trapped misalignment ($\mathcal{Z}_N$ axion) [195]

## 8 CP-violating couplings

Combined constraints [219]

### Scalar-nucleon

- Red giants [220]
- MICROSCOPE [221].
- Eot-Wash [222, 223, 224]
- Irvine [225]. Corrected to $2\sigma$ limit by [226]
- HUST [227, 228, 229, 230].
- Stanford [231]
- IUPUI [232].
- Wuhan [226]

### Pseudoscalar-electron

- Red giants [220]
- Eot-wash [233]
- NIST [234]
- SMILE [235].
- QUAX [236, 237]
- Washington [238, 239].
- XENON1T [240]
- Magnon (projection) [159]
- QUAX (projection) [236].

### Pseudoscalar-nucleon

- Neutron star cooling [181]
- Washington [241]. Limit taken from [242].
- SMILE [235].
- Mainz [243]
- ARIADNE (projection) [244]
- CASPEr-wind (projection) [193]
- DM comagnetometer (projection) [178]

## 9 Scalars

### Scalar-photon

- Globular clusters [89]
- Eot-Wash (EP) [245]
- Fifth force [246]
- MICROSCOPE [221]
- AURIGA [247]
- BACON [248]
- Cs/Cav [249]
- DAMNED [250]
- Dy/Dy [251]
- Dy/Quartz [190]
- Dynamic Decoupling [252]
- GEO600 [253]
- Holometer [254]
- H/Quartz/Sapphire [255]
- PTB (Yb+, Sr clock) [256]
- $I_2$ [257]
- Rb/Cs [258]
- Sr/Si [259]
- AEDGE (projection) [260]
- AION (projection) [260]
- DUAL (projection) [246]
- MAGIS (projection) [261]
- Nuclear clock (projection) [262]
- Mechanical Resonators (projection) [263]

### Scalar-electron

- Red giants [220]
- White dwarfs [264]
- Eot-Wash (EP) [245]
- Fifth force [246]
- MICROSCOPE [221]
- AURIGA [247]
- Cs/Cav [249]
- DAMNED [250]
- GEO600 [253]
- Holometer [254]
- H/Quartz/Sapphire [255]
- $I_2$ [257]
- H/Si [259]
- Rb/Quartz [190]
- AEDGE (projection) [260]
- AION (projection) [260]
- DUAL (projection) [246]
- Optical microwave clock (projection) [246]
- Optical cavities [265]
- SrOH [266]
- Mechanical Resonators (projection) [263]
- IPTA (mock data) [267]

## 10 Vectors

### B-L coupling

- Casimir [268, 269, 270]
- Eot-Wash (EP) [271]
- Eot-Wash (ISL) [272]
- MICROSCOPE [273]
- DM stability [274]
- Horizontal branch [220]
- Sun [220]
- Eot-Wash (DM) [275]
- LIGO (O1) [276]
- LIGO/VIRGO [276]
- Asteroids (projection) [277]
- LISA (projection) [277]
- MAGIS (projection) [261]
- Optomechanical membranes (projection) [278]
- SKA (projection) [279]
- Torsion balance (projection) [279]

## 11 Dark photons

Combined constraints [280]

### SM photon-DP transitions

- Coulomb [281, 282, 283, 284, 285],
- Plimpton & Lawton's experiment [286, 285]
- Atomic spectroscopy [287]
- Atomic force microscopy (AFM) [285]
- Static magnetic field of the Earth [288, 289, 290]
- Static magnetic field of Jupiter [291, 290].
- ALPs [57]
- ALPS-II (projection) [292]
- SPring-8 [293]
- UWA-LSW [294, 295]
- ADMX-LSW [296]
- CROWS [60].
- DarkSRF [297]
- TEXONO [298]
- Crab nebula [299]
- COBE and FIRAS [300]
- STAX [301]

### Production in stars

- CAST [302]
- SHIP [303]
- HINODE [304]
- HB and RG stars [305]
- Neutron stars [306]
- Solar neutrinos [307]
- XENON1T [308]

### Dark matter cosmology/astro

- Arias et al. [217]
- Witte et al. [309, 310]
- Caputo et al. [311, 300],
- IGM [312],
- Leo T dwarf [313]
- Gas clouds [314]

### Dark matter experiments

- Reinterpreted axion limits [280]
- BREAD (projection) [43]
- DAMIC [315]
- Dark E-field Radio [316]
- DM Pathfinder [317]
- DOSUE-RR [318]
- FAST Radio antenna [319]
- FUNK [320]
- LAMPOST [321]
- LOFAR (solar corona) [322]
- MuDHI [323]
- ORGAN [324]
- ORPHEUS [325]
- QUALIPHIDE [326]
- Quantum cyclotron [327]
- SENSEI [328]
- SHUKET [329]
- SuperCDMS [330]
- SuperMAG [331, 332]
- SQuAD [333],
- SQMS [334],
- Tokyo dish antennae experiments [335, 336, 337]
- WISPDMX [338]
- XENON(100,1T,nT) [164, 240, 339, 340, 308, 341].

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