References for AxionLimits webpage

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1 Axion-photon

Haloscopes

- ABRACADABRA [1, 2]
- ADBC [3]
- ADMX [4, 5, 6, 7]
- ADMX-Sidecar [8, 9]
- ADMX-SLIC [10]
- CAPP [11, 12, 13, 14, 15, 16, 17, 18, 19, 20]
- CAST-CAPP [21]
- DANCE [22]
- BASE [23]
- GrAHal [24]
- HAYSTAC [25, 26, 27]
- LIDA [28]
- ORGAN [29, 30, 31]
- QUAX [32, 33, 34, 35]
- RADES [36, 37]
- RBF [38, 39]
- SHAFT [40]
- TASEH [41]
- SuperMAG [42]
- UF [43, 44]
- UPLOAD-DOWNLOAD [45, 46]
- ABRACADABRA (projection) [47]
- ADBC (projection) [48]
- ADMX (projection) [49]
- aLIGO (projection) [50]
- ALPHA (projection) [51, 52]
- BabyIAXO-RADES (projection) [53]
- BRASS (projection) [54]
- BREAD (projection) [55]
- CADEx (projection) [56]
- DALI (projection) [57]
- DarkGEO (projection) [58]
- DM-Radio (projection) [59, 60]
- DANCE (projection) [61]
- LAMPOST (projection) [62]
- MADMAX (projection) [63]
- FLASH (projection) [64, 65]
- QUAX (projection) [66]
- ORGAN (projection) [29]
- TOORAD (projection) [67]
- Twisted Anyon Cavity (projection) [68]
- WISPLC (projection) [69]
- SRF heterodyne cavity (projection) [70]

LSW/Helioscopes

- ALPS [71]
- CAST [72, 73]
- CROWS [74]
- OSQAR [75]
- PVLAS [76]
- SAPPHIRES [77, 78]
- ALPS-II (projection) [79]
- IAXO (projection) [80]
- IAXO (Galactic SN) [81]
- WISPFI (projection) [82]

Astro

- 21 cm power spectrum (projection) [83]
- ATHENA (projection) [84]
- Axion star explosions [85]
- Betelgeuse [86]
- BICEP/KECK [87]
- Black hole polarimetry [88]
- Breakthrough Listen (Doppler shifted radio line in MW) [89]
- Bullet Cluster (archival radio data) [90]
- Cosmic IR background (hint) [91]
- Chandra (Hydra) [92]
- Chandra (M87) [93]
- Chandra (NG7 1275) [94]
- Chandra (H1821+643) [95]
- CMB Anisotropies [96, 97]
- COBE/FIRAS+Planck spectral dist. [98]
- Diffuse gamma-rays [99]
- Diffuse SN ALPs [100] (see also [101])
- Distance ladder [102]
- Fermi-LAT (NGC 1275) [103]
- Fermi-LAT (Extragalactic SNe) [104]
- Fermi-LAT (Quasars) [105]
- FIRAS [106]
- Gamma-ray attenuation (ALP dark matter) [107]
- Globular clusters (R parameter) [108]
- Globular clusters (R_2 parameter) [109]
- GW170817 (Fermi) [110]
- GW170817 [111]
- HAWC (TeV Blazars) [112]
- HESS (PKS 2155-304) [113]
- INTEGRAL (ALP decay) [114]
- Leo T gas temperature [115]
- M82 (NuSTAR) [116]
- MAGIC (Perseus galaxy cluster) [117]
- Magnetic white dwarfs (X-rays) [118]
- Magnetic white dwarf (polarization) [119]
- MOJAVE [120]
- Mrk 421 (ARGO-YBJ+Fermi): [121]
- Mrk 421 (ARGO-YBJ+MAGIC): [122]
- Neutron Stars (Foster et al. 2020) [123]
- Neutron Stars (Darling 2020) [124]
- Neutron Stars (Battye et al. 2021) [125]
- Neutron stars (Foster et al. 2022) [126]
- Neutron Stars (Battye et al. 2023) [127]
- NuSTAR (decaying dark matter, recast from Sterile nu) [128, 129, 130]
- Planck cosmic birefringence [131]
- POLARBEAR [132, 133]
- PPTA+QUIJOTE [134]
- Pulsar polarisation arrays (projection) [135]
- Pulsar polar cap [136]
- PSR J0437-4715 polarisation [137]
- Red supergiant [138]
- Solar neutrinos [139]
- Stellar axion background [140]
- SN1987A-γ (ALP decay) [141, 142, 143]
- SN1987A-γ (low mass ALP conversion) [144, 142, 145]
- SN1987A-γ,ν (high mass ALPs) [146, 147, 99]
- SN1987A (PVO) [148]
- Sgr A* [149]
- Low-energy supernovae (ALP decay) [99]
- Solar basin (NuSTAR) [150]
- Solar basin (NuSTAR and SPHINX) [151]
- Super Star clusters [152]
- SPT [153]
- Telescopes (Haystack) [154]
- Telescopes (MUSE) [155] (updated from: [156])
- Telescopes (VIMOS) [157]
- Telescopes (HST) [158, 159]
- Telescopes (JWST) [160]
- Telescopes (WINERED) [161, 162]

- Telescopes (eROSITA) [163]
- Fermi galactic SN (projection) [164]
- THESEUS (projection) [165]
- eROSITA (projection) [166]
- XRISM (projection) [167]
- White dwarf initial-final mass relation [168]
- XMM-Newton (decaying DM ALPs) [169]

Cosmology

- Ionisation fraction, EBL, X-rays [170]
- BBN+$N_{\rm eff}$ [171]
- Freeze in [172]

2 Heavy ALP-photon coupling

- ATALS (PbPb) [173]
- BaBar [174]
- Beam dump [175, 176, 174, 177, 178]
- Belle II [179]
- BESIII [180]
- CMS (PbPb) [181]
- EuXFL [182]
- LEP [183]
- LHC (pp)[184]
- MiniBooNE [185]
- NOMAD [186]
- OPAL [184]
- PrimEx [187, 188]
- CONUS (projection) [189]
- DUNE (projection) [190]
- FASER LLP (projection) [191]

3 Axion-electron

- Electron g-2 [192]
- EDELWEISS [193]
- Fermionic axion interferometer [194]
- Magnon non-demolition [195]
- DarkSide-50 [196]
- GERDA [197]
- LUX [198]
- Old comagnetometers [199]
- Panda-X [200]
- Torsion pendulum (spin force) [201]
- Torsion pendulum (axion wind) [202]
- SuperCDMS [203]
- XENON1T [204, 205]
- XENONnT [206]
- XENON1T (Solar basin) [207]
- Red giants (ωCen) [208]
- Solar neutrinos [209]
- Electron storage ring (projection) [210]
- Axion wind multilayer (projection) [211]
- Magnons (projection) [212]
- Polaritons (projection) [213]
- DARWIN (projection) [214]
- LZ (projection) [215]
- QUAX [216, 217]
- NV Centers (projection) [218]
- Superconductors (projection) [219]
- Semiconductors (projection) [220]
- Spin-orbit coupling (projection) [221]
- Torsion pendulum (projection) [222]
- YIG (projection) [212]
- White dwarf hint [223]
- Freeze-in irreducible axions [172]
- X-rays (1-loop decay) [224]

4 Axion-nucleon

Note: CASPEr and nEDM limits account for stochastic correction reported in [225]

- Casimir effect (fifth force) [226]
- CASPEr-ZULF-Comagnetometer [227]
- CASPEr-ZULF-Sidechain [228]
- ChangE [229, 230]
- Hefei Spin-based amplifiers [231]
- nEDM (ultracold neutrons and mercury) [232]
- NASDUCK [233, 234]
- PSI HgM (nEDM) [235]
- K-3He comagnetometer (fifth force) [236]
- K-3He comagnetometer (dark matter) [237]
- JEDI [238]
- Old comagnetometers [199]
- Torsion balance [239]
- Neutron star cooling [240] (corrected from [241])
- SN1987A Cooling [242, 243]
- SNO (deuterium dissasociation) [244]
- Proton storage ring (projection) [245]
- Electrostatic storage ring (projection) [210]
- DM comagnetometer (projection) [199]
- CASPEr-gradient (projection) [228]
- Superfluid helium-3 HPD (projection) [246]
- MnCO3 (projection) [247]

5 Axion-EDM

- Axinovae [248]
- Beam EDM [249]
- BBN (dark matter) [250]
- CASPEr-electric [251]
- nEDM [232]
- HfF^+ [252]
- I_2^+/Ca^+ [253]
- JEDI [238]
- Rb/Quartz [254]
- SN1987A [255]
- *Planck*+BAO thermal axion bound [256]
- CASPEr-electric (projection) [257]
- Storage Ring EDM (projection) [257]
- Polarisation haloscope (projection) [258]

6 Axion-top

Axion-top coupling limits originally compiles in Ref. [259]

7 Axion mass versus f_a

- BBN (dark matter) [250]
- Beam EDM [249]
- Binary pulsars and Solar core constraint on $\bar{\theta}$ [260]. I include minor numerical corrections made by [261, 262].
- GW170817 [263]
- HfF^+ [252]
- Rb/Quartz [254]
- JEDI [238]
- nEDM [232]
- Tritium decay [264]
- Piezoaxionic effect (projection) [265]
- *Planck*+BAO thermal axion bound [256]
- SN1987A [255]
- Neutron stars (projection) [260].
- NS-NS and NS-BH Inspirals (projection) [260].
- White dwarfs [266]
- Polarisation haloscope (projection) [258]

7.1 Black hole superradiance

- Baryakhtar et al. [267] (just Stellar mass BHs)
- Mehta et al. [267] (Stellar mass and SMBHs)
- Stott [268]
- Ünal et al. [269] (Quasars)
- Cardoso et al. [270] (dark photon)

8 Axion theory predictions

8.1 Post-inflation QCD axion

- Ballesteros et al. [271]
- Buschmann et al. 2020 [272]
- Buschmann et al. 2021 [273]
- Bonati et al. [274]
- Borsanyi et al. [275]
- Berkowitz et al. [276]
- Dine et al. [277]
- Petreczky et al. [278]
- Fleury & Moore [279]
- Klaer & Moore [280]
- Gorghetto et al. [281]
- Saikawa et al. (2019) [80]
- Saikawa et al. (2024) [282]

8.2 Other dark matter predictions

- ALP Cogenesis [283]
- Early matter domination [284]
- Post-inflation ALP misalignment [285, 286]
- Trapped misalignment ($\mathcal{Z}_N$ axion) [261]

9 CP-violating couplings

Combined constraints [287]

Scalar-nucleon

- Red giants [288]
- MICROSCOPE [289].
- Eot-Wash [290, 291, 292]
- Irvine [293]. Corrected to 2σ limit by [294]
- HUST [295, 296, 297, 298].
- Stanford [299]
- IUPUI [300].
- Wuhan [294]

Pseudoscalar-electron

- Red giants [288]
- Eot-wash [301]
- e^+e^- Penning trap [302]
- NIST [303]
- SMILE [304]
- Perihelion shift [305]
- QUAX [306, 307, 308]
- Washington [201, 309].
- XENON1T [310]
- ACME (projection) [311]
- Magnon (projection) [213]
- QUAX (projection) [306].

Pseudoscalar-nucleon

- Neutron star cooling [240]
- Hefei (Earth) [312]
- Hefei (mm) [313]
- Washington [314]. Limit taken from [315].
- SMILE [304].
- Mainz [316]
- Moon/Sun [317]
- Yb trap (projection) [311]
- ARIADNE (projection) [318]
- CASPEr-wind (projection) [257]
- DM comagnetometer (projection) [199]
- Fifth force Ne-Rb-K comagnetometer (projection) [319]

10 Scalars

Scalar-photon

- Globular clusters [109]
- Eot-Wash (EP) [320]
- Fifth force [321, 322, 323, 324]
- MICROSCOPE [289]
- AURIGA [325]
- BACON [326]
- Cs/Cav [327]
- DAMNED [328]
- Dy/Dy [329]
- Dy/Quartz [254]
- Dynamic Decoupling [330]
- GEO600 [331]
- LIGO O3 [332], see also [333]
- Holometer [334]
- H/Quartz/Sapphire [335]
- PTB (Yb+, Sr clock) [336]
- I_2 [337]
- Rb/Cs [338]
- Sr/Si [339]
- Yb/Sr [340]
- AEDGE (projection) [341]
- AION (projection) [341]
- DUAL (projection) [342]
- MAGIS (projection) [343]
- Nuclear clock (projection) [344]
- Mechanical Resonators (projection) [345]

Scalar-electron

- Red giants [288]
- White dwarfs [346]
- Eot-Wash (EP) [320]
- Fifth force [321, 322, 323, 324]
- MICROSCOPE [289]
- AURIGA [325]
- Cavities [347]
- Cs/Cav [327]
- DAMNED [328]
- GEO600 [331]
- Holometer [334]
- H/Quartz/Sapphire [335]
- LIGO O3 [332], see also [333]
- I_2 [337]
- H/Si [339]
- Rb/Quartz [254]
- Yb/Cs [348]
- NANOGrav 15-year PTA [349]
- FOCOS (nuclear clock projection) [350]
- AEDGE (projection) [341]
- AION (projection) [341]
- DUAL (projection) [342]
- HELIOS (projection) [351]
- Optical microwave clock (projection) [352]
- Optical cavities [353]
- SrOH [354]
- Mechanical Resonators (projection) [345]
- IPTA (mock data) [355]

11 Vectors

B-L coupling

- Casimir [356, 357, 358]
- Eot-Wash (EP) [359]
- Eot-Wash (ISL) [360]
- MICROSCOPE [361]
- DM stability [362]
- Horizontal branch [363]
- Red giant [363]
- Sun [363]
- Eot-Wash (DM) [364]
- LIGO (O1) [365]
- LIGO/VIRGO [365]
- LISA Pathfinder [366, 367]
- PPTA [368]
- Asteroids (projection) [369]
- HELIOS (projection) [351]
- LISA (projection) [369]
- MAGIS (projection) [343]
- Optomechanical membranes (projection) [370]
- SKA (projection) [371]
- Torsion balance (projection) [371]
- STE-QUEST (projection) [372]

12 Dark photons

Combined constraints [373]

SM photon-DP transitions

- Coulomb [374, 375, 376, 377, 378],
- Plimpton & Lawton's experiment [379, 378]
- Atomic spectroscopy [380]
- Atomic force microscopy (AFM) [378]
- Static magnetic field of the Earth [381, 382, 383]
- Static magnetic field of Jupiter [384, 383].
- Jupiter B-field/Juno mission [385]
- ALPs [71]
- ALPS-II (projection) [386]
- SPring-8 [387]
- UWA-LSW [388, 389]
- ADMX-LSW [390]
- CROWS [74].
- DarkSRF [391]
- DarkSRF (projection) [392]
- TEXONO [393]
- Crab nebula [394]
- COBE and FIRAS [395]
- STAX (projection) [396]

Production in stars

- CAST [397]
- SHIPS [398]
- HINODE [399]
- IAXO (modified for longitudinal mode) [400]
- New globular cluster bound [401]
- Old stellar bounds: Solar-L, HB and RG stars [363] (see also [402])
- Neutron stars [403]
- Solar neutrinos [404]
- XENON1T [405]

Dark matter cosmology/astro

- Arias et al. [285]
- Witte et al. [406, 407]
- Caputo et al. [408, 395],
- ISM [409],
- Leo T dwarf [410]
- Gas clouds [410, 411]
- JWST [412]
- Parker Solar Probe [413]
- Planck + unWISE [414]

Dark matter experiments

- Reinterpreted axion limits [373]
- APEX [415]
- ALPHA [52]
- AMAILS [416]
- BRASS-p [417]
- BREAD (projection) [55]
- Dandelion (projection) [418]
- DarkSide-50 [196]
- DAMIC [419]
- Dark E-field Radio [420, 421]
- DM Pathfinder [422]
- DOSUE-RR [423, 424]
- FAST Radio antenna [425]
- FUNK [426]
- GigaBREAD [427]
- LAMPOST [428]
- LOFAR (solar corona) [429]
- MuDHI [430]
- ORGAN [431]
- ORPHEUS [432]
- QUALIPHIDE [433]
- Quantum cyclotron [434]
- SENSEI [435]
- SHUKET [436]
- SuperCDMS [437]
- SuperMAG [438, 439]
- SQuAD [440],
- SQMS [441],
- SUPAX [442]
- SRF scanning [443]
- Tokyo dish antennae experiments [444, 445, 446]
- WISPDMX [447]
- XENON(100,1T,nT) [448, 310, 449, 450, 405, 451].

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