

1 Axion-photon

Haloscopes

- ABRACADABRA [1, 2]
- ADBC [3]
- ADMX [4, 5, 6, 7, 8]
- ADMX-Sidecar [9, 10]
- ADMX-SLIC [11]
- CAPP [12, 13, 14, 15, 16, 17, 18, 19, 20, 21]
- CAST-CAPP [22]
- DANCE [23]
- BASE [24]
- GrAHal [25]
- HAYSTAC [26, 27, 28, 29, 30]
- LIDA [31]
- MADMAX [32]
- ORGAN [33, 34, 35, 36]
- QUAX [37, 38, 39, 40, 41]
- RADES [42, 43]
- RBF [44, 45]
- SHAFT [46]
- TASEH [47]
- SuperMAG [48, 49]
- UF [50, 51]
- UPLOAD-DOWNLOAD [52, 53]
- ABRACADABRA (projection) [54]
- ADBC (projection) [55]
- ADMX (projection) [56]
- aLIGO (projection) [57]
- ALPHA (projection) [58, 59]
- BabyIAXO-RADES (projection) [60]
- BRASS (projection) [61]
- BREAD (projection) [62]
- CADEX (projection) [63]
- DALI (projection) [64]
- DarkGEO (projection) [65]
- DM-Radio (projection) [66, 67]
- DANCE (projection) [68]
- EQC (projection) [69]
- LAMPOST (projection) [70]
- MADMAX (projection) [71]
- FLASH (projection) [72, 73]
- QUAX (projection) [74]
- ORGAN (projection) [33]
- TOORAD (projection) [75]
- Twisted Anyon Cavity (projection) [76]
- WISPLC (projection) [77]
- SRF heterodyne cavity (projection) [78]

LSW/Helioscopes

- ALPS [79]
- CAST [80, 81, 82]
- CROWS [83]
- OSQAR [84]
- PVLAS [85]
- SAPPHIRES [86, 87, 88]
- ALPS-II (projection) [89]
- IAXO (projection) [90]
- IAXO (Galactic SN) [91]
- WISPMI (projection) [92]

Astro

- 21 cm power spectrum (projection) [93]
- ATHENA (projection) [94]
- Axion star explosions [95]
- Betelgeuse [96]
- BICEP/KECK [97]
- Black hole polarimetry [98]
- Breakthrough Listen (Doppler shifted radio line in MW) [99]
- Bullet Cluster (archival radio data) [100]
- Cosmic IR background (hint) [101]
- Chandra (Hydra) [102]
- Chandra (M87) [103]
- Chandra (NG7 1275) [104]
- Chandra (H1821+643) [105]
- CMB Anisotropies [106, 107]
- CMB Patchy screening [108, 109]
- COBE/FIRAS+Planck spectral dist. axion decay [110]
- COBE/FIRAS - low mass axion-photon conversion [111]
- Diffuse gamma-rays [112]
- Diffuse SN ALPs [113] (see also [114])
- Distance ladder [115]
- EPTA [116]
- Fermi-LAT (NGC 1275) [117]
- Fermi-LAT (Extragalactic SNe) [118]
- Fermi-LAT (Quasars) [119]
- Gamma-ray attenuation (ALP dark matter) [120]
- Gamma-ray decay [93]
- Globular clusters (R parameter) [121]
- Globular clusters (R_2 parameter) [122]
- GW170817 (Fermi) [123]
- GW170817 [124]
- HAWC (TeV Blazars) [125]
- HESS (PKS 2155-304) [126]
- INTEGRAL (ALP decay) [127]
- Leo T gas temperature [128]
- M82 (NuSTAR) [129]
- M82 (NuSTAR - axion decay) [130]
- MAGIC (Perseus galaxy cluster) [131]
- Magnetic white dwarfs (X-rays) [132]
- Magnetic white dwarf (polarization) [133]
- MOJAVE [134]
- Mrk 421 (ARGO-YBJ+Fermi): [135]
- Mrk 421 (ARGO-YBJ+MAGIC): [136]
- Mrk 421 (Fermi+HAWC): [137]
- Neutron Stars (Foster et al. 2020) [138]
- Neutron Stars (Darling 2020) [139]
- Neutron Stars (Battye et al. 2021) [140]
- Neutron stars (Foster et al. 2022) [141]
- Neutron Stars (Battye et al. 2023) [142]
- NuSTAR (decaying dark matter, recast from Sterile nu) [143, 144, 145]
- NuSTAR (Sun) [146]
- Planck cosmic birefringence [147]
- POLARBEAR [148, 149]
- PPTA+QUIJOTE [150]
- Pulsar polarisation arrays (projection) [151]
- Pulsar polarisation arrays (PPTA analysis) [152]
- Pulsar polar cap [153]
- PSR J0437-4715 polarisation [154]
- Red supergiant [155]
- Solar neutrinos [156]
- Stellar axion background [157]
- SN1987A- γ (ALP decay) [158, 159, 160]
- SN1987A- γ (low mass ALP conversion) [161, 159, 162]
- SN1987A- γ,ν (high mass ALPs) [163, 164, 112]
- SN1987A (PVO) [165]
- Sgr A* [166]
- Low-energy supernovae (ALP decay) [112]
- Solar basin (NuSTAR) [167]
- Solar basin (NuSTAR and SPHINX) [168]
- Super Star clusters [169]
- SPT [170]
- Telescopes (Haystack) [171]

- Telescopes (MUSE) [172] (updated from: [173])
- Telescopes (VIMOS) [174]
- Telescopes (HST) [175, 176]
- Telescopes (HST-dwarfs) [177]
- Telescopes (JWST) [178]
- Telescopes (WINERED) [179, 180]
- Telescopes (eROSITA) [181]
- Fermi galactic SN (projection) [182]
- THESEUS (projection) [183]
- eROSITA (projection) [184]
- XRISM (projection) [185]
- White dwarf initial-final mass relation [186]
- XMM-Newton (decaying DM ALPs) [187]

Cosmology

- Ionisation fraction, EBL, X-rays [188]
- BBN+ N_{eff} [189]
- Freeze in [190]
- Cosmic background [191]

2 Heavy ALP-photon coupling

- ATALS (PbPb) [192]
- BaBar [193]
- Beam dump [194, 195, 193, 196, 197]
- Belle II [198]
- BESIII [199, 200]
- CMS (PbPb) [201]
- EuXFL [202]
- FASER (limit) [203]
- LEP [204]
- LHC (pp)[205]
- MiniBooNE [206]
- NOMAD [207]
- OPAL [205]
- PrimEx [208, 209]
- GlueX [210]
- CONUS (projection) [211]
- DUNE (projection) [212]
- FASER LLP (projection) [213]

3 Axion-electron

- Electron g-2 [214]
- EDELWEISS [215]
- Fermionic axion interferometer [216]
- Magnon non-demolition [217]
- DarkSide-50 [218]
- GERDA [219]
- LUX [220]
- Old comagnetometers [221]
- Panda-X [222, 223, 224]
- Torsion pendulum (spin force) [225]
- Torsion pendulum (axion wind) [226]
- SuperCDMS [227]
- XENON1T [228, 229]
- XENONnT [230]
- XENON1T (Solar basin) [231]
- Red giants (ω Cen) [232]
- Solar neutrinos [233]
- Electron storage ring (projection) [234]
- Axion wind multilayer (projection) [235]
- Magnons (projection) [236]
- Polaritons (projection) [237]
- DARWIN (projection) [238]
- LZ (projection) [239]
- QUAX [240, 241]
- NV Centers (projection) [242]
- Superconductors (projection) [243]
- Semiconductors (projection) [244]
- Spin-orbit coupling (projection) [245]
- Torsion pendulum (projection) [246]
- YIG (projection) [236]
- White dwarf hint [247]
- Freeze-in irreducible axions [190]
- X-rays (1-loop decay) [248]

4 Axion-nucleon

Note: CASPEr and nEDM limits account for stochastic correction reported in [249]

- Casimir effect (fifth force) [250]

- CASPEr-ZULF-Comagnetometer [251]
- CASPEr-ZULF-Sidechain [252]
- ChangE [253, 254]
- Hefei Spin-based amplifiers [255]
- nEDM (ultracold neutrons and mercury) [256]
- NASDUCK [257, 258]
- PSI HgM (nEDM) [259]
- K-3He comagnetometer (fifth force) [260]
- K-3He comagnetometer (dark matter) [261]
- Mainz-Krakow comagnetometers [262]
- JEDI [263]
- Old comagnetometers [221]
- Torsion balance [264]
- Neutron star cooling [265] (corrected from [266])
- SN1987A Cooling [267, 268]
- Super-Kamiokande diffuse supernova ALPs [269]
- SNO (deuterium dissociation) [270]
- Proton storage ring (projection) [271]
- Electrostatic storage ring (projection) [234]
- DM comagnetometer (projection) [221]
- CASPEr-gradient (projection) [252]
- Superfluid helium-3 HPD (projection) [272]
- MnCO₃ (projection) [273]

5 Axion-EDM

- Axinovae [274]
- Beam EDM [275]
- BBN (dark matter) [276]
- CASPEr-electric [277]
- nEDM [256]
- HfF⁺ [278]
- I_2^+/Ca^+ [279]
- JEDI [263]
- ONIX [280]
- Rb/Quartz [281]
- SN1987A [282, 283]
- *Planck*+BAO thermal axion bound [284]
- CASPEr-electric (projection) [285]
- Storage Ring EDM (projection) [285]
- Polarisation haloscope (projection) [286]

6 Axion-top

Axion-top coupling limits originally compiled in Ref. [287, 288]

7 Axion mass versus f_a

- BBN (dark matter) [276]
- Beam EDM [275]
- Binary pulsars and Solar core constraint on $\bar{\theta}$ [289]. I include minor numerical corrections made by [290, 291].
- GW170817 [292]
- HfF⁺ [278]
- Rb/Quartz [281]
- JEDI [263]
- nEDM [256]
- Tritium decay [293]
- 40K decay [294]
- Piezoaxionic effect (projection) [295]
- *Planck*+BAO thermal axion bound [284]
- SN1987A [282, 283]
- Neutron stars (projection) [289].
- NS-NS and NS-BH Inspirals (projection) [289].
- White dwarfs [296]
- Polarisation haloscope (projection) [286]
- Neutron star cooling (Gomez-Banon et al. [297], Kumamoto et al. [298])

7.1 Black hole superradiance

- Baryakhtar et al. [299] (just Stellar mass BHs)
- Mehta et al. [299] (Stellar mass and SMBHs)
- Stott [300]
- Ünal et al. [301] (Quasars)
- Hoof et al. [302]
- Witte and Mummery [303]
- Cardoso et al. [304] (dark photon)

8 Axion theory predictions

8.1 Post-inflation QCD axion

- Ballesteros et al. [305]
- Buschmann et al. 2020 [306]
- Buschmann et al. 2021 [307]
- Benabou et al. 2024 [308]
- Bonati et al. [309]
- Borsanyi et al. [310]
- Berkowitz et al. [311]
- Dine et al. [312]
- Petreczky et al. [313]
- Fleury & Moore [314]
- Klaer & Moore [315]
- Gorghetto et al. [316]
- Saikawa et al. (2019) [90]
- Saikawa et al. (2024) [317]
- Beyer et al. (2023) [318]
- Kim et al. (2024) [319]

8.2 Other dark matter predictions

- ALP Cogenesis [320]
- Early matter domination [321]
- Post-inflation ALP misalignment [322, 323]
- Trapped misalignment (\mathcal{Z}_N axion) [290]

9 CP-violating couplings

Combined constraints [324]

Scalar-nucleon

- Red giants [325]
- MICROSCOPE [326].
- Eot-Wash [327, 328, 329]
- Irvine [330]. Corrected to 2σ limit by [331]
- HUST [332, 333, 334, 335].
- Stanford [336]
- IUPUI [337].
- Wuhan [331]

Pseudoscalar-electron

- Red giants [325]
- Eot-wash [338]
- e^+e^- Penning trap [339]
- NIST [340]
- SMILE [341]
- Perihelion shift [342]
- QUAX [343, 344, 345]
- Washington [225, 346].
- XENON1T [347]
- ACME (projection) [348]
- Magnon (projection) [237]
- QUAX (projection) [343].

Pseudoscalar-nucleon

- Neutron star cooling [265]
- Hefei (Earth) [349]
- Hefei (mm) [350]
- Washington [351]. Limit taken from [352].
- SMILE [341].
- Mainz [353]
- Moon/Sun [354]
- Yb trap (projection) [348]
- ARIADNE (projection) [355]
- CASPER-wind (projection) [285]
- DM comagnetometer (projection) [221]
- Fifth force Ne-Rb-K comagnetometer (projection) [356]

10 Scalars

Scalar-photon

- Globular clusters [122]
- Eot-Wash (EP) [357]
- Fifth force [358, 359, 360, 361]
- MICROSCOPE [326]
- AURIGA [362]
- BACON [363]
- Cs/Cav [364]
- DAMNED [365]
- Dy/Dy [366]
- Dy/Quartz [281]
- Dynamic Decoupling [367]
- GEO600 [368]
- LIGO O3 [369], see also [370]
- Holometer [371]
- H/Quartz/Sapphire [372]
- PTB (Yb+, Sr clock) [373]
- I₂ [374]
- Rb/Cs [375]
- Sr/Si [376]
- Yb/Sr [377]
- AEDGE (projection) [378]
- AION (projection) [378]
- DUAL (projection) [379]
- MAGIS (projection) [380]
- Nuclear clock (projection) [381]
- Mechanical Resonators (projection) [382]

Scalar-electron

- Red giants [325]
- White dwarfs [383]
- Eot-Wash (EP) [357]
- Fifth force [358, 359, 360, 361]
- MICROSCOPE [326]
- AURIGA [362]
- Cavities [384]
- Cs/Cav [364]
- DAMNED [365]
- GEO600 [368]
- Holometer [371]
- H/Quartz/Sapphire [372]
- LIGO O3 [369], see also [370]
- I₂ [374]
- H/Si [376]
- Rb/Quartz [281]
- Yb/Cs [385]
- NANOGrav 15-year PTA [386]
- FOCOS (nuclear clock projection) [387]
- AEDGE (projection) [378]
- AION (projection) [378]
- DUAL (projection) [379]
- HELIOS (projection) [388]
- Optical microwave clock (projection) [389]
- Optical cavities [390]
- SrOH [391]
- Mechanical Resonators (projection) [382]
- IPTA (mock data) [392]

- SKA (projection) [410]
- Torsion balance (projection) [410]
- STE-QUEST (projection) [411]

11 Vectors

B-L coupling

- Casimir [393, 394, 395]
- Eot-Wash (EP) [396]
- Eot-Wash (ISL) [397]
- MICROSCOPE [398]
- DM stability [399]
- Horizontal branch [400]
- Red giant [400]
- Sun [400]
- Eot-Wash (DM) [401]
- KAGRA (DM) [402]
- LIGO (O1) [403]
- LIGO/VIRGO [403]
- LISA Pathfinder [404, 405]
- PPTA [406]
- POLONAISE [407]
- Asteroids (projection) [408]
- HELIOS (projection) [388]
- LISA (projection) [408]
- MAGIS (projection) [380]
- Optomechanical membranes (projection) [409]

12 Dark photons

Combined constraints [412]

SM photon-DP transitions

- Coulomb [413, 414, 415, 416, 417],
- Plimpton & Lawton’s experiment [418, 417]
- Atomic spectroscopy [419]
- Atomic force microscopy (AFM) [417]
- Static magnetic field of the Earth [420, 421, 422]
- Static magnetic field of Jupiter [423, 422].
- Jupiter B-field/Juno mission [424]
- ALPs [79]
- ALPS-II (projection) [425]
- SPring-8 [426]
- UWA-LSW [427, 428]
- ADMX-LSW [429]
- CROWS [83].
- DarkSRF [430]
- DarkSRF (projection) [431]
- TEXONO [432]
- Crab nebula [433]
- COBE and FIRAS [434]
- STAX (projection) [435]

Production in stars

- CAST [436]
- SHIPS [437]
- HINODE [438]
- IAXO (modified for longitudinal mode) [439]
- New globular cluster bound [440]
- Old stellar bounds: Solar-L, HB and RG stars [400] (see also [441])
- Neutron stars [442]
- Solar neutrinos [443]
- XENON1T [444]

Dark matter cosmology/astro

- Blazars [445]
- Dark matter, Arias et al. [322]
- Dark matter, Witte et al. [446, 447]
- COBE/FIRAS, Caputo et al. [448, 434]
- COBE/FIRAS with Spectral distortions [449, 450]
- Lyman-alpha [451]
- ISM [452],
- Leo T dwarf [453]
- Gas clouds [453, 454]
- JWST [455]
- Parker Solar Probe [456]
- Planck + unWISE [457]
- INTEGRAL [458, 459]

Dark matter experiments

- Reinterpreted axion limits [412]
- APEX [460]
- ALPHA [59]
- AMAILS [461]
- BRASS-p [462]
- BREAD (projection) [62]
- Dandelion (projection) [463]
- DarkSide-50 [218]
- DAMIC [464]
- Dark E-field Radio [465, 466]
- DM Pathfinder [467]
- DOSUE-RR [468, 469]
- FAST Radio antenna [470]
- FUNK [471]
- GigaBREAD [472]
- Hefei haloscope [473]
- MADMAX [474]
- LAMPOST [475]
- LOFAR (solar corona) [476]
- MuDHI [477]
- ORGAN [478, 36]
- ORPHEUS [479]
- QUALIPHIDE [480]
- Quantum cyclotron [481]
- SENSEI [482]
- SHUKET [483]
- SuperCDMS [484]
- SuperMAG [485, 486, 49]

- SQuAD [487],
- SQMS [488],
- SUPAX [489]
- SRF scanning [490]
- Tokyo dish antennae experiments [491, 492, 493]
- WISPDMM [494]
- XENON(100,1T,nT) [495, 347, 496, 497, 444, 498].

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