

1 Axion-photon

Haloscopes

- ABRACADABRA [1, 2]
- ADBC [3]
- ADMX [4, 5, 6, 7, 8, 9]
- ADMX-Sidecar [10, 11]
- ADMX-SLIC [12]
- CAPP [13, 14, 15, 16, 17, 18, 19, 20, 21, 22]
- CAST-CAPP [23]
- DANCE [24]
- BASE [25]
- GrAHal [26]
- HAYSTAC [27, 28, 29, 30, 31]
- LIDA [32]
- MADMAX [33]
- ORGAN [34, 35, 36, 37]
- QUAX [38, 39, 40, 41, 42]
- RADES [43, 44]
- RBF [45, 46]
- SHAFT [47]
- TASEH [48]
- SuperMAG [49, 50]
- Eskdalemuir [51]
- UF [52, 53]
- UPLOAD-DOWNLOAD [54, 55]
- ABRACADABRA (projection) [56]
- ADBC (projection) [57]
- ADMX (projection) [58]
- aLIGO (projection) [59]
- ALPHA (projection) [60, 61]
- BabyIAXO-RADES (projection) [62]
- BRASS (projection) [63]
- BREAD (projection) [64]
- CADEx (projection) [65]
- DALI (projection) [66]
- DarkGEO (projection) [67]
- DM-Radio (projection) [68, 69]
- DANCE (projection) [70]
- EQC (projection) [71]
- LAMPOST (projection) [72]
- MADMAX (projection) [73]
- FLASH (projection) [74, 75]
- QUAX (projection) [76]
- ORGAN (projection) [34]
- TOORAD (projection) [77]
- Twisted Anyon Cavity (projection) [78]
- WISPLC (projection) [79]
- SRF heterodyne cavity (projection) [80]

LSW/Helioscopes

- ALPS [81]
- CAST [82, 83, 84]
- CROWS [85]
- OSQAR [86]
- PVLAS [87]
- SAPPHIRES [88, 89, 90]
- ALPS-II (projection) [91]
- IAXO (projection) [92]
- IAXO (Galactic SN) [93]
- WISPF1 (projection) [94]

Astro

- 21 cm power spectrum (projection) [95]
- ATHENA (projection) [96]
- Axion star explosions [97]
- Betelgeuse [98]
- BICEP/KECK [99]
- Black hole polarimetry [100]
- Breakthrough Listen (Doppler shifted radio line in MW) [101]
- Bullet Cluster (archival radio data) [102]
- Cosmic IR background (hint) [103]
- Chandra (Hydra) [104]
- Chandra (M87) [105]
- Chandra (NG7 1275) [106]
- Chandra (H1821+643) [107]
- CMB Anisotropies [108, 109]
- CMB Patchy screening [110, 111]
- COBE/FIRAS+Planck spectral dist. axion decay [112]
- COBE/FIRAS - low mass axion-photon conversion [113]
- Diffuse gamma-rays [114]
- Diffuse SN ALPs [115] (see also [116])
- Distance ladder [117]
- EPTA [118]
- Fermi-LAT (NGC 1275) [119]
- Fermi-LAT (Extragalactic SNe) [120]
- Fermi-LAT (Quasars) [121]
- Gamma-ray attenuation (ALP dark matter) [122]
- Gamma-ray decay [95]
- Globular clusters (R parameter) [123]
- Globular clusters (R_2 parameter) [124]
- GW170817 (Fermi) [125]
- GW170817 [126]
- HAWC (TeV Blazars) [127]
- HESS (PKS 2155-304) [128]
- INTEGRAL (ALP decay) [129]
- Leo T gas temperature [130]
- M82 (NuSTAR) [131]
- M82 (NuSTAR - axion decay) [132]
- MAGIC (Perseus galaxy cluster) [133]
- Magnetic white dwarfs (X-rays) [134]
- Magnetic white dwarf (polarization) [135]
- Magnetic white dwarf (polarization - Keck/Lick observations) [136]
- MOJAVE [137]
- Mrk 421 (ARGO-YBJ+Fermi): [138]
- Mrk 421 (ARGO-YBJ+MAGIC): [139]
- Mrk 421 (Fermi+HAWC): [140]
- Neutron Stars (Foster et al. 2020) [141]
- Neutron Stars (Darling 2020) [142]
- Neutron Stars (Battye et al. 2021) [143]
- Neutron stars (Foster et al. 2022) [144]
- Neutron Stars (Battye et al. 2023) [145]
- NuSTAR (decaying dark matter, recast from Sterile nu) [146, 147, 148]
- NuSTAR (Sun) [149]
- Planck cosmic birefringence [150]
- POLARBEAR [151, 152]
- PPTA+QUIJOTE [153]
- Pulsar polarisation arrays (projection) [154]
- Pulsar polarisation arrays (PPTA analysis) [155]
- Pulsar polar cap [156]
- PSR J0437-4715 polarisation [157]
- Red supergiant [158]
- Solar neutrinos [159]
- Stellar axion background [160]
- SN1987A- γ (ALP decay) [161, 162, 163]
- SN1987A- γ (low mass ALP conversion) [164, 162, 165]
- SN1987A- γ, ν (high mass ALPs) [166, 167, 114]
- SN1987A (PVO) [168]
- Sgr A* [169]
- Low-energy supernovae (ALP decay) [114]
- Low-energy supernovae (ALP decay) - Fiorillo et update [170]
- Solar basin (NuSTAR) [171]
- Solar basin (NuSTAR and SPHINX) [172]

- Super Star clusters [173]
- SPT [174]
- Telescopes (DESI) [175]
- Telescopes (Haystack) [176]
- Telescopes (MUSE) [177] (updated from: [178])
- Telescopes (VIMOS) [179]
- Telescopes (HST) [180, 181]
- Telescopes (HST-dwarfs) [182]
- Telescopes (JWST - Janish 2023) [183]
- Telescopes (JWST - Pinetti 2025) [184]
- Telescopes (JWST - Saha 2025) [185]
- Telescopes (WINERED) [186, 187]
- Telescopes (eROSITA) [188]
- Telescopes (XRISM) [189]
- Fermi galactic SN (projection) [190]
- THESEUS (projection) [191]
- eROSITA (projection) [192]
- XRISM (projection) [193]
- White dwarf initial-final mass relation [194]
- XMM-Newton (decaying DM ALPs) [195]

Cosmology

- Ionisation fraction, EBL, X-rays [196]
- BBN+ N_{eff} [197]
- Freeze in [198]
- Cosmic background [199]

2 Heavy ALP-photon coupling

- ATALS (PbPb) [200]
- BaBar [201]
- Beam dump [202, 203, 201, 204, 205]
- Belle II [206]
- BESIII [207, 208]
- CMS (PbPb) [209]
- EuXFL [210]
- FASER (limit) [211]
- LEP [212]
- LHC (pp) [213]
- MiniBooNE [214]
- NOMAD [215]
- OPAL [213]
- PrimEx [216, 217]
- GlueX [218]
- CONUS (projection) [219]
- DUNE (projection) [220]
- FASER LLP (projection) [221]

3 Axion-electron

- Electron g-2 [222]
- EDELWEISS [223]
- Fermionic axion interferometer [224]
- Magnon non-demolition [225]
- DarkSide-50 [226]
- GERDA [227]
- LUX [228]
- Old comagnetometers [229]
- Panda-X [230, 231, 232]
- Torsion pendulum (spin force) [233]
- Torsion pendulum (axion wind) [234]
- SuperCDMS [235]
- XENON1T [236, 237]
- XENONnT [238]
- XENON1T (Solar basin) [239]
- Red giants (ω Cen) [240]
- Solar neutrinos [241]
- Electron storage ring (projection) [242]
- Axion wind multilayer (projection) [243]
- Magnons (projection) [244]
- Polaritons (projection) [245]
- DARWIN (projection) [246]
- LZ (projection) [247]
- QUAX [248, 249]
- NV Centers (projection) [250]
- Superconductors (projection) [251]
- Semiconductors (projection) [252]
- Spin-orbit coupling (projection) [253]
- Torsion pendulum (projection) [254]
- YIG (projection) [244]
- White dwarf hint [255]
- Freeze-in irreducible axions [198]
- X-rays (1-loop decay) [256]

4 Axion-nucleon

Note: CASPEr and nEDM limits account for stochastic correction reported in [257]

- Casimir effect (fifth force) [258]
- CASPEr-ZULF-Comagnetometer [259]
- CASPEr-ZULF-Sidechain [260]
- ChangE [261, 262]
- Hefei Spin-based amplifiers [263]
- nEDM (ultracold neutrons and mercury) [264]
- NASDUCK [265, 266]
- PSI HgM (nEDM) [267]
- K-3He comagnetometer (fifth force) [268]
- K-3He comagnetometer (dark matter) [269]
- Mainz-Krakow comagnetometers [270]
- JEDI [271]
- Old comagnetometers [229]
- Torsion balance [272]
- Neutron star cooling [273] (corrected from [274])
- SN1987A Cooling [275, 276]
- Super-Kamiokande diffuse supernova ALPs [277]
- SNO (deuterium dissasociation) [278]
- Xe-129 fifth force [279]
- Proton storage ring (projection) [280]
- Electrostatic storage ring (projection) [242]
- DM comagnetometer (projection) [229]
- CASPEr-gradient (projection) [260]
- Superfluid helium-3 HPD (projection) [281]
- MnCO₃ (projection) [282]

5 Axion-EDM

- Axinovae [283]
- Beam EDM [284]
- BBN (dark matter) [285]
- CASPEr-electric [286]
- nEDM [264]
- HfF⁺ [287]
- I_2^+/Ca^+ [288]
- JEDI [271]
- ONIX [289]
- Rb/Quartz [290]
- SN1987A [291, 292]
- *Planck*+BAO thermal axion bound [293]
- CASPEr-electric (projection) [294]
- Storage Ring EDM (projection) [294]
- Polarisation haloscope (projection) [295]

6 Axion-top

Axion-top coupling limits originally compiled in Ref. [296, 297]

7 Axion mass versus f_a

- BBN (dark matter) [285]
- Beam EDM [284]
- Binary pulsars and Solar core constraint on $\bar{\theta}$ [298]. I include minor numerical corrections made by [299, 300].
- GW170817 [301]
- HfF⁺ [287]
- MICROSCOPE [302]
- Rb/Quartz [290]
- JEDI [271]
- nEDM [264]
- Tritium decay [303]
- 40K decay [304]
- Yb+ E3/E2 [305]
- Piezoaxionic effect (projection) [306]
- *Planck*+BAO thermal axion bound [293]
- SN1987A [291, 292]
- Neutron stars (projection) [298].
- NS-NS and NS-BH Inspirals (projection) [298].
- White dwarfs [307]
- Polarisation haloscope (projection) [295]
- Neutron star cooling (Gomez-Banon et al. [308], Kumamoto et al. [309])

7.1 Black hole superradiance

- Baryakhtar et al. [310] (just Stellar mass BHs)
- Mehta et al. [310] (Stellar mass and SMBHs)
- Stott [311]
- Ünal et al. [312] (Quasars)
- Hoof et al. [313]
- Witte and Mummery [314]
- Cardoso et al. [315] (dark photon)

8 Axion theory predictions

8.1 Post-inflation QCD axion

- Ballesteros et al. [316]
- Buschmann et al. 2020 [317]
- Buschmann et al. 2021 [318]
- Benabou et al. 2024 [319]
- Bonati et al. [320]
- Borsanyi et al. [321]
- Berkowitz et al. [322]
- Dine et al. [323]
- Petreczky et al. [324]
- Fleury & Moore [325]
- Klaer & Moore [326]
- Gorghetto et al. [327]
- Saikawa et al. (2019) [92]
- Saikawa et al. (2024) [328]
- Beyer et al. (2023) [329]
- Kim et al. (2024) [330]

8.2 Other dark matter predictions

- ALP Cogenesis [331]
- Early matter domination [332]
- Post-inflation ALP misalignment [333, 334]
- Trapped misalignment (\mathcal{Z}_V axion) [299]

9 CP-violating couplings

Combined constraints [335]

Scalar-nucleon

- Red giants [336]
- MICROSCOPE [337].
- Eot-Wash [338, 339, 340]
- Irvine [341]. Corrected to 2σ limit by [342]
- HUST [343, 344, 345, 346].
- Stanford [347]
- IUPUI [348].
- Wuhan [342]

Pseudoscalar-electron

- Red giants [336]
- Eot-wash [349]
- e^+e^- Penning trap [350]
- NIST [351]
- SMILE [352]
- Perihelion shift [353]
- QUAX [354, 355, 356]
- Washington [233, 357].
- XENON1T [358]
- ACME (projection) [359]
- Magnon (projection) [245]
- QUAX (projection) [354].

Pseudoscalar-nucleon

- Neutron star cooling [273]
- Hefei (Earth) [360]
- Hefei (mm) [361]
- Washington [362]. Limit taken from [363].
- SMILE [352].
- Mainz [364]
- Moon/Sun [365]
- Yb trap (projection) [359]
- ARIADNE (projection) [366]
- CASPER-wind (projection) [294]
- DM comagnetometer (projection) [229]
- Fifth force Ne-Rb-K comagnetometer (projection) [367]

10 Scalars

Scalar-photon

- Globular clusters [124]
- Eot-Wash (EP) [368]
- Fifth force [369, 370, 371, 372]
- MICROSCOPE [337]
- AURIGA [373]
- BACON [374]
- Cs/Cav [375]
- DAMNED [376]
- Dy/Dy [377]
- Dy/Quartz [290]
- Dynamic Decoupling [378]
- GEO600 [379]
- LIGO O3 [380], see also [381]
- Holometer [382]
- H/Quartz/Sapphire [383]
- PTB (Yb+, Sr clock) [384]
- I₂ [385]
- Rb/Cs [386]
- Sr/Si [387]
- QSNET [388]
- QSNET (projection) [389]
- AEDGE (projection) [390]
- AION (projection) [390]
- DUAL (projection) [391]
- MAGIS (projection) [392]
- Nuclear clock (projection) [393]
- Mechanical Resonators (projection) [394]

Scalar-electron

- Red giants [336]
- White dwarfs [395]
- Eot-Wash (EP) [368]
- Fifth force [369, 370, 371, 372]
- MICROSCOPE [337]
- AURIGA [373]
- Cavities [396]
- Cs/Cav [375]
- DAMNED [376]
- GEO600 [379]
- Holometer [382]
- H/Quartz/Sapphire [383]
- LIGO O3 [380], see also [381]
- I₂ [385]
- H/Si [387]
- Rb/Quartz [290]
- Yb/Cs [397]
- NANOGrav 15-year PTA [398]
- FOCOS (nuclear clock projection) [399]
- AEDGE (projection) [390]
- AION (projection) [390]
- DUAL (projection) [391]
- HELIOS (projection) [400]
- QSNET (projection) [389]
- Optical microwave clock (projection) [401]
- Optical cavities [402]
- SrOH [403]
- Mechanical Resonators (projection) [394]
- IPTA (mock data) [404]

- MAGIS (projection) [392]
- Optomechanical membranes (projection) [421]
- SKA (projection) [422]
- Torsion balance (projection) [422]
- STE-QUEST (projection) [423]

11 Vectors

B-L coupling

- Casimir [405, 406, 407]
- Eot-Wash (EP) [408]
- Eot-Wash (ISL) [409]
- MICROSCOPE [410]
- DM stability [411]
- Horizontal branch [412]
- Red giant [412]
- Sun [412]
- Eot-Wash (DM) [413]
- KAGRA (DM) [414]
- LIGO (O1) [415]
- LIGO/VIRGO [415]
- LISA Pathfinder [416, 417]
- PPTA [418]
- POLONAISE [419]
- Asteroids (projection) [420]
- HELIOS (projection) [400]
- LISA (projection) [420]

12 Dark photons

Combined constraints [424]

SM photon-DP transitions

- Coulomb [425, 426, 427, 428, 429],
- Plimpton & Lawton’s experiment [430, 429]
- Atomic spectroscopy [431]
- Atomic force microscopy (AFM) [429]
- Static magnetic field of the Earth [432, 433, 434]
- Static magnetic field of Jupiter [435, 434].
- Jupiter B-field/Juno mission [436]
- ALPs [81]
- ALPS-II (projection) [437]
- SPring-8 [438]
- UWA-LSW [439, 440]
- ADMX-LSW [441]
- CROWS [85].
- DarkSRF [442]
- DarkSRF (projection) [443]
- TEXONO [444]
- Crab nebula [445]
- COBE and FIRAS [446]
- STAX (projection) [447]

Production in stars

- CAST [448]
- SHIPS [449]
- HINODE [450]
- IAXO (modified for longitudinal mode) [451]
- New globular cluster bound [452]
- Old stellar bounds: Solar-L, HB and RG stars [412] (see also [453])
- Neutron stars [454]
- Solar neutrinos [455]
- XENON1T [456]

Dark matter cosmology/astro

- Blazars [457]
- Dark matter, Arias et al. [333]
- Dark matter, Witte et al. [458, 459]
- COBE/FIRAS, Caputo et al. [460, 446]
- COBE/FIRAS with Spectral distortions [461, 462]
- Lyman-alpha [463]
- ISM [464],
- Leo T dwarf [465]
- Gas clouds [465, 466]
- JWST [467]
- Parker Solar Probe [468]
- Planck + unWISE [469]
- INTEGRAL [470, 471]

Dark matter experiments

- Reinterpreted axion limits [424]
- APEX [472]
- ALPHA [61]
- AMAILS [473]
- BRASS-p [474]
- BREAD (projection) [64]
- Dandelion (projection) [475]
- DarkSide-50 [226]
- DAMIC [476]
- Dark E-field Radio [477, 478]
- DM Pathfinder [479]
- DOSUE-RR [480, 481]
- FAST Radio antenna [482]
- FUNK [483]
- GigaBREAD [484]
- Hefei haloscope [485]
- MADMAX [486]
- LAMPOST [487]
- LOFAR (solar corona) [488]
- MuDHI [489]
- ORGAN [490, 37]
- ORPHEUS [491]
- QUALIPHIDE [492]
- Quantum cyclotron [493]
- SENSEI [494]
- SHUKET [495]
- SuperCDMS [496]
- SuperMAG [497, 498, 50]

- SQuAD [499],
- SQMS [500],
- SUPAX [501]
- SRF scanning [502]
- Tokyo dish antennae experiments [503, 504, 505]
- WISPDMM [506]
- XENON(100,1T,nT) [507, 358, 508, 509, 456, 510].

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