

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

LSW/Helioscopes

- ALPS [66]
- CAST [67, 68]
- CROWS [69]
- OSQAR [70]
- PVLAS [71]
- SAPPHIRES [72, 73]
- ALPS-II (projection) [74]
- IAXO (projection) [75]
- IAXO (Galactic SN) [76]
- WISPF1 (projection) [77]

Astro

- Axion star explosions [78]
- Betelgeuse [79]
- BICEP/KECK [80]
- Black hole polarimetry [81]
- Breakthrough Listen (Doppler shifted radio line in MW) [82]
- Bullet Cluster (archival radio data) [83]
- Cosmic IR background (hint) [84]
- Chandra (Hydra) [85]
- Chandra (M87) [86]
- Chandra (NG7 1275) [87]
- Chandra (H1821+643) [88]
- CMB Anisotropies [89, 90]
- COBE/FIRAS+Planck spectral dist. [91]
- Diffuse gamma-rays [92]
- Diffuse SN ALPs [93] (see also [94])
- Distance ladder [95]
- Fermi-LAT (NGC 1275) [96]
- Fermi-LAT (Extragalactic SNe) [97]
- Fermi-LAT (Quasars) [98]
- Gamma-ray attenuation (ALP dark matter) [99]
- Globular clusters (R parameter) [100]
- Globular clusters (R_2 parameter) [101]
- HAWC (TeV Blazars) [102]
- HESS (PKS 2155-304) [103]
- INTEGRAL (ALP decay) [104]
- Leo T gas temperature [105]
- MAGIC (Perseus galaxy cluster) [106]
- Magnetic white dwarfs (X-rays) [107]
- Magnetic white dwarf (polarization) [108]
- MOJAVE [109]
- Mrk 421 (ARGO-YBJ+Fermi): [110]
- Mrk 421 (ARGO-YBJ+MAGIC): [111]
- Neutron Stars (Foster et al. 2020) [112]
- Neutron Stars (Darling 2020) [113]
- Neutron Stars (Battye et al. 2021) [114]
- Neutron stars (Foster et al. 2022) [115]
- Neutron Stars (Battye et al. 2023) [116]
- NuSTAR (decaying dark matter, recast from Sterile ν) [117, 118, 119]
- Planck cosmic birefringence [120]
- POLARBEAR [121]
- PPTA+QUIJOTE [122]
- Pulsar polarisation arrays (projection) [123]
- Pulsar polar cap [124]
- PSR J0437-4715 polarisation [125]
- Red supergiant [126]
- Solar neutrinos [127]
- Stellar axion background [128]
- SN1987A- γ (ALP decay) [129, 130, 131]
- SN1987A- γ (low mass ALP conversion) [132, 130]
- SN1987A- γ, ν (high mass ALPs) [133, 134, 92]
- SN1987A (PVO) [135]
- Sgr A* [136]
- Low-energy supernovae (ALP decay) [92]
- Solar basin (NuSTAR) [137]
- Solar basin (NuSTAR and SPHINX) [138]
- Star clusters [139]
- SPT [140]
- Telescopes (Haystack) [141]
- Telescopes (MUSE) [142] (updated from: [143])
- Telescopes (VIMOS) [144]
- Telescopes (HST) [145, 146]
- Telescopes (JWST) [147]
- Telescopes (WINERED) [148, 149]
- Telescopes (eROSITA) [150]
- Fermi galactic SN (projection) [151]
- THESEUS (projection) [152]
- eROSITA (projection) [153]
- White dwarf initial-final mass relation [154]
- XMM-Newton (decaying DM ALPs) [155]

Cosmology

- Ionisation fraction, EBL, X-rays [156]
- BBN+ N_{eff} [157]
- Freeze in [158]

2 Heavy ALP-photon coupling

- ATALS (PbPb) [159]
- BaBar [160]
- Beam dump [161, 162, 160, 163, 164]
- Belle II [165]
- BESIII [166]
- CMS (PbPb) [167]
- LEP [168]
- LHC (pp)[169]
- MiniBooNE [170]
- NOMAD [171]
- OPAL [169]
- PrimEx [172, 173]
- CONUS (projection) [174]
- DUNE (projection) [175]
- FASER LLP (projection) [176]

3 Axion-electron

- Electron g-2 [177]
- EDELWEISS [178]
- Fermionic axion interferometer [179]
- Magnon non-demolition [180]
- DarkSide-50 [181]
- GERDA [182]
- LUX [183]
- Old comagnetometers [184]
- Panda-X [185]
- Torsion pendulum (spin force) [186]
- Torsion pendulum (axion wind) [187]
- SuperCDMS [188]
- XENON1T [189, 190]
- XENONnT [191]
- XENON1T (Solar basin) [192]
- Red giants (ω Cen) [193]
- Solar neutrinos [194]
- Electron storage ring (projection) [195]
- Axion wind multilayer (projection) [196]
- Magnons (projection) [197]
- Polaritons (projection) [198]
- DARWIN (projection) [199]
- LZ (projection) [200]
- QUAX [201, 202]
- NV Centers (projection) [203]
- Superconductors (projection) [204]
- Semiconductors (projection) [205]
- Spin-orbit coupling (projection) [206]
- Torsion pendulum (projection) [207]
- YIG (projection) [197]
- White dwarf hint [208]
- Freeze-in irreducible axions [158]
- X-rays (1-loop decay) [209]

4 Axion-nucleon

Note: CASPER and nEDM limits account for stochastic correction reported in [210]

- Casimir effect (fifth force) [211]
- CASPER-ZULF-Comagnetometer [212]
- CASPER-ZULF-Sidechain [213]
- ChangE [214, 215]
- Hefei Spin-based amplifiers [216]
- nEDM (ultracold neutrons and mercury) [217]
- NASDUCK [218, 219]
- PSI HgM (nEDM) [220]
- K-3He comagnetometer (fifth force) [221]
- K-3He comagnetometer (dark matter) [222]
- JEDI [223]
- Old comagnetometers [184]
- Torsion balance [224]
- Neutron star cooling [225] (corrected from [226])
- SN1987A Cooling [227, 228]
- SNO (deuterium dissasociation) [229]
- Proton storage ring (projection) [230]
- Electrostatic storage ring (projection) [195]
- DM comagnetometer (projection) [184]
- CASPER-gradient (projection) [213]
- Superfluid helium-3 HPD (projection) [231]
- MnCO₃ (projection) [232]

5 Axion-EDM

- Axinovae [233]
- Beam EDM [234]
- BBN (dark matter) [235]
- CASPER-electric [236]
- nEDM [217]
- HfF^+ [237]
- JEDI [223]
- Rb/Quartz [238]
- SN1987A [239]
- *Planck*+BAO thermal axion bound [240]
- CASPER-electric (projection) [241]
- Storage Ring EDM (projection) [241]
- Polarisation haloscope (projection) [242]

6 Axion-top

Axion-top coupling limits originally compiles in Ref. [243]

7 Axion mass versus f_a

- BBN (dark matter) [235]
- Beam EDM [234]
- Binary pulsars and Solar core constraint on $\bar{\theta}$ [244]. I include minor numerical corrections made by [245, 246].
- GW170817 [247]
- HfF^+ [237]
- Rb/Quartz [238]
- JEDI [223]
- nEDM [217]
- Tritium decay [248]
- Piezoaxionic effect (projection) [249]
- *Planck*+BAO thermal axion bound [240]
- SN1987A [239]
- Neutron stars (projection) [244].
- NS-NS and NS-BH Inspirals (projection) [244].
- White dwarfs [250]
- Polarisation haloscope (projection) [242]

7.1 Black hole superradiance

- Baryakhtar et al. [251] (just Stellar mass BHs)
- Mehta et al. [251] (Stellar mass and SMBHs)
- Stott [252]
- Ünal et al. [253] (Quasars)
- Cardoso et al. [254] (dark photon)

8 Axion theory predictions

8.1 Post-inflation QCD axion

- Ballesteros et al. [255]
- Buschmann et al. 2020 [256]
- Buschmann et al. 2021 [257]
- Bonati et al. [258]
- Borsanyi et al. [259]
- Berkowitz et al. [260]
- Dine et al. [261]
- Petreczky et al. [262]
- Fleury & Moore [263]
- Klaer & Moore [264]
- Gorghetto et al. [265]
- Saikawa et al. (2019) [75]
- Saikawa et al. (2024) [266]

8.2 Other dark matter predictions

- ALP Cogenesis [267]
- Early matter domination [268]
- Post-inflation ALP misalignment [269, 270]
- Trapped misalignment (\mathcal{Z}_N axion) [245]

9 CP-violating couplings

Combined constraints [271]

Scalar-nucleon

- Red giants [272]
- MICROSCOPE [273].
- Eot-Wash [274, 275, 276]
- Irvine [277]. Corrected to 2σ limit by [278]
- HUST [279, 280, 281, 282].
- Stanford [283]
- IUPUI [284].
- Wuhan [278]

Pseudoscalar-electron

- Red giants [272]
- Eot-wash [285]
- e^+e^- Penning trap [286]
- NIST [287]
- SMILE [288]
- Perihelion shift [289]
- QUAX [290, 291, 292]
- Washington [186, 293].
- XENON1T [294]
- ACME (projection) [295]
- Magnon (projection) [198]
- QUAX (projection) [290].

Pseudoscalar-nucleon

- Neutron star cooling [225]
- Hefei (Earth) [296]
- Hefei (mm) [297]
- Washington [298]. Limit taken from [299].
- SMILE [288].
- Mainz [300]
- Moon/Sun [301]
- Yb trap (projection) [295]
- ARIADNE (projection) [302]
- CASPER-wind (projection) [241]
- DM comagnetometer (projection) [184]
- Fifth force Ne-Rb-K comagnetometer (projection) [303]

10 Scalars

Scalar-photon

- Globular clusters [101]
- Eot-Wash (EP) [304]
- Fifth force [305, 306, 307, 308]
- MICROSCOPE [273]
- AURIGA [309]
- BACON [310]
- Cs/Cav [311]
- DAMNED [312]
- Dy/Dy [313]
- Dy/Quartz [238]
- Dynamic Decoupling [314]
- GEO600 [315]
- LIGO O3 [316]
- Holometer [317]
- H/Quartz/Sapphire [318]
- PTB (Yb+, Sr clock) [319]
- I₂ [320]
- Rb/Cs [321]
- Sr/Si [322]
- Yb/Sr [323]
- AEDGE (projection) [324]
- AION (projection) [324]
- DUAL (projection) [325]
- MAGIS (projection) [326]
- Nuclear clock (projection) [327]
- Mechanical Resonators (projection) [328]

Scalar-electron

- Red giants [272]
- White dwarfs [329]
- Eot-Wash (EP) [304]
- Fifth force [305, 306, 307, 308]
- MICROSCOPE [273]
- AURIGA [309]
- Cavities [330]
- Cs/Cav [311]
- DAMNED [312]
- GEO600 [315]
- Holometer [317]
- H/Quartz/Sapphire [318]
- I₂ [320]
- H/Si [322]
- Rb/Quartz [238]
- Yb/Cs [331]
- LIGO O3 [316]
- NANOGrav 15-year PTA [332]
- FOCOS (nuclear clock projection) [333]
- AEDGE (projection) [324]
- AION (projection) [324]
- DUAL (projection) [325]
- HELIOS (projection) [334]
- Optical microwave clock (projection) [335]
- Optical cavities [336]
- SrOH [337]
- Mechanical Resonators (projection) [328]
- IPTA (mock data) [338]

- Torsion balance (projection) [354]
- STE-QUEST (projection) [355]

11 Vectors

B-L coupling

- Casimir [339, 340, 341]
- Eot-Wash (EP) [342]
- Eot-Wash (ISL) [343]
- MICROSCOPE [344]
- DM stability [345]
- Horizontal branch [346]
- Red giant [346]
- Sun [346]
- Eot-Wash (DM) [347]
- LIGO (O1) [348]
- LIGO/VIRGO [348]
- LISA Pathfinder [349, 350]
- PPTA [351]
- Asteroids (projection) [352]
- HELIOS (projection) [334]
- LISA (projection) [352]
- MAGIS (projection) [326]
- Optomechanical membranes (projection) [353]
- SKA (projection) [354]

12 Dark photons

Combined constraints [356]

SM photon-DP transitions

- Coulomb [357, 358, 359, 360, 361],
- Plimpton & Lawton’s experiment [362, 361]
- Atomic spectroscopy [363]
- Atomic force microscopy (AFM) [361]
- Static magnetic field of the Earth [364, 365, 366]
- Static magnetic field of Jupiter [367, 366].
- Jupiter B-field/Juno mission [368]
- ALPs [66]
- ALPS-II (projection) [369]
- SPring-8 [370]
- UWA-LSW [371, 372]
- ADMX-LSW [373]
- CROWS [69].
- DarkSRF [374]
- DarkSRF (projection) [375]
- TEXONO [376]
- Crab nebula [377]
- COBE and FIRAS [378]
- STAX (projection) [379]

Production in stars

- CAST [380]
- SHIPS [381]
- HINODE [382]
- IAXO (modified for longitudinal mode) [383]
- New globular cluster bound [384]
- Old stellar bounds: Solar-L, HB and RG stars [346] (see also [385])
- Neutron stars [386]
- Solar neutrinos [387]
- XENON1T [388]

Dark matter cosmology/astro

- Arias et al. [269]
- Witte et al. [389, 390]
- Caputo et al. [391, 378],
- ISM [392],
- Leo T dwarf [393]
- Gas clouds [393, 394]

Dark matter experiments

- Reinterpreted axion limits [356]
- ALPHA [47]
- AMAILS [395]
- BRASS-p [396]
- BREAD (projection) [50]
- Dandelion (projection) [397]
- DarkSide-50 [181]
- DAMIC [398]
- Dark E-field Radio [399]
- DM Pathfinder [400]
- DOSUE-RR [401, 402]
- FAST Radio antenna [403]
- FUNK [404]
- GigaBREAD [405]
- LAMPOST [406]
- LOFAR (solar corona) [407]
- MuDHI [408]
- ORGAN [409]
- ORPHEUS [410]
- QUALIPHIDE [411]
- Quantum cyclotron [412]
- SENSEI [413]
- SHUKET [414]
- SuperCDMS [415]
- SuperMAG [416, 417]
- SQuAD [418],
- SQMS [419],
- SUPAX [420]
- SRF scanning [421]
- Tokyo dish antennae experiments [422, 423, 424]
- WISPDMS [425]
- XENON(100,1T,nT) [426, 294, 427, 428, 388, 429].

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