

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]
- LIDA [29]
- ORGAN [30, 31, 32, 33]
- QUAX [34, 35, 36, 37]
- RADES [38, 39]
- RBF [40, 41]
- SHAFT [42]
- TASEH [43]
- SuperMAG [44, 45]
- UF [46, 47]
- UPLOAD-DOWNLOAD [48, 49]
- ABRACADABRA (projection) [50]
- ADBC (projection) [51]
- ADMX (projection) [52]
- aLIGO (projection) [53]
- ALPHA (projection) [54, 55]
- BabyIAXO-RADES (projection) [56]
- BRASS (projection) [57]
- BREAD (projection) [58]
- CADEx (projection) [59]
- DALI (projection) [60]
- DarkGEO (projection) [61]
- DM-Radio (projection) [62, 63]
- DANCE (projection) [64]
- LAMPOST (projection) [65]
- MADMAX (projection) [66]
- FLASH (projection) [67, 68]
- QUAX (projection) [69]
- ORGAN (projection) [30]
- TOORAD (projection) [70]
- Twisted Anyon Cavity (projection) [71]
- WISPLC (projection) [72]
- SRF heterodyne cavity (projection) [73]

LSW/Helioscopes

- ALPS [74]
- CAST [75, 76, 77]
- CROWS [78]
- OSQAR [79]
- PVLAS [80]
- SAPPHIRES [81, 82]
- ALPS-II (projection) [83]
- IAXO (projection) [84]
- IAXO (Galactic SN) [85]
- WISPMI (projection) [86]

Astro

- 21 cm power spectrum (projection) [87]
- ATHENA (projection) [88]
- Axion star explosions [89]
- Betelgeuse [90]
- BICEP/KECK [91]
- Black hole polarimetry [92]
- Breakthrough Listen (Doppler shifted radio line in MW) [93]
- Bullet Cluster (archival radio data) [94]
- Cosmic IR background (hint) [95]
- Chandra (Hydra) [96]
- Chandra (M87) [97]
- Chandra (NG7 1275) [98]
- Chandra (H1821+643) [99]
- CMB Anisotropies [100, 101]
- COBE/FIRAS+Planck spectral dist. [102]
- Diffuse gamma-rays [103]
- Diffuse SN ALPs [104] (see also [105])
- Distance ladder [106]
- Fermi-LAT (NGC 1275) [107]
- Fermi-LAT (Extragalactic SNe) [108]
- Fermi-LAT (Quasars) [109]
- FIRAS [110]
- Gamma-ray attenuation (ALP dark matter) [111]
- Globular clusters (R parameter) [112]
- Globular clusters (R_2 parameter) [113]
- GW170817 (Fermi) [114]
- GW170817 [115]
- HAWC (TeV Blazars) [116]
- HESS (PKS 2155-304) [117]
- INTEGRAL (ALP decay) [118]
- Leo T gas temperature [119]
- M82 (NuSTAR) [120]
- MAGIC (Perseus galaxy cluster) [121]
- Magnetic white dwarfs (X-rays) [122]
- Magnetic white dwarf (polarization) [123]
- MOJAVE [124]
- Mrk 421 (ARGO-YBJ+Fermi): [125]
- Mrk 421 (ARGO-YBJ+MAGIC): [126]
- Neutron Stars (Foster et al. 2020) [127]
- Neutron Stars (Darling 2020) [128]
- Neutron Stars (Battye et al. 2021) [129]
- Neutron stars (Foster et al. 2022) [130]
- Neutron Stars (Battye et al. 2023) [131]
- NuSTAR (decaying dark matter, recast from Sterile nu) [132, 133, 134]
- NuSTAR (Sun) [135]
- Planck cosmic birefringence [136]
- POLARBEAR [137, 138]
- PPTA+QUIJOTE [139]
- Pulsar polarisation (projection) [140]
- Pulsar polar cap [141]
- PSR J0437-4715 polarisation [142]
- Red supergiant [143]
- Solar neutrinos [144]
- Stellar axion background [145]
- SN1987A- γ (ALP decay) [146, 147, 148]
- SN1987A- γ (low mass ALP conversion) [149, 147, 150]
- SN1987A- γ, ν (high mass ALPs) [151, 152, 103]
- SN1987A (PVO) [153]
- Sgr A* [154]
- Low-energy supernovae (ALP decay) [103]
- Solar basin (NuSTAR) [155]
- Solar basin (NuSTAR and SPHINX) [156]
- Super Star clusters [157]
- SPT [158]
- Telescopes (Haystack) [159]
- Telescopes (MUSE) [160] (updated from: [161])
- Telescopes (VIMOS) [162]
- Telescopes (HST) [163, 164]
- Telescopes (JWST) [165]
- Telescopes (WINERED) [166, 167]

- Telescopes (eROSITA) [168]
- Fermi galactic SN (projection) [169]
- THESEUS (projection) [170]
- eROSITA (projection) [171]
- XRISM (projection) [172]
- White dwarf initial-final mass relation [173]
- XMM-Newton (decaying DM ALPs) [174]

Cosmology

- Ionisation fraction, EBL, X-rays [175]
- BBN+ N_{eff} [176]
- Freeze in [177]
- Cosmic background [178]

2 Heavy ALP-photon coupling

- ATALS (PbPb) [179]
- BaBar [180]
- Beam dump [181, 182, 180, 183, 184]
- Belle II [185]
- BESIII [186]
- CMS (PbPb) [187]
- EuXFL [188]
- LEP [189]
- LHC (pp)[190]
- MiniBooNE [191]
- NOMAD [192]
- OPAL [190]
- PrimEx [193, 194]
- CONUS (projection) [195]
- DUNE (projection) [196]
- FASER LLP (projection) [197]

3 Axion-electron

- Electron g-2 [198]
- EDELWEISS [199]
- Fermionic axion interferometer [200]
- Magnon non-demolition [201]
- DarkSide-50 [202]
- GERDA [203]
- LUX [204]
- Old comagnetometers [205]
- Panda-X [206]
- Torsion pendulum (spin force) [207]
- Torsion pendulum (axion wind) [208]
- SuperCDMS [209]
- XENON1T [210, 211]
- XENONnT [212]
- XENON1T (Solar basin) [213]
- Red giants (ω Cen) [214]
- Solar neutrinos [215]
- Electron storage ring (projection) [216]
- Axion wind multilayer (projection) [217]
- Magnons (projection) [218]
- Polaritons (projection) [219]
- DARWIN (projection) [220]
- LZ (projection) [221]
- QUAX [222, 223]
- NV Centers (projection) [224]
- Superconductors (projection) [225]
- Semiconductors (projection) [226]
- Spin-orbit coupling (projection) [227]
- Torsion pendulum (projection) [228]
- YIG (projection) [218]
- White dwarf hint [229]
- Freeze-in irreducible axions [177]
- X-rays (1-loop decay) [230]

4 Axion-nucleon

Note: CASPEr and nEDM limits account for stochastic correction reported in [231]

- Casimir effect (fifth force) [232]
- CASPEr-ZULF-Comagnetometer [233]
- CASPEr-ZULF-Sidechain [234]
- ChangE [235, 236]
- Hefei Spin-based amplifiers [237]
- nEDM (ultracold neutrons and mercury) [238]
- NASDUCK [239, 240]
- PSI HgM (nEDM) [241]
- K-3He comagnetometer (fifth force) [242]

- K-3He comagnetometer (dark matter) [243]
- Mainz-Krakow comagnetometers [244]
- JEDI [245]
- Old comagnetometers [205]
- Torsion balance [246]
- Neutron star cooling [247] (corrected from [248])
- SN1987A Cooling [249, 250]
- SNO (deuterium dissasociation) [251]
- Proton storage ring (projection) [252]
- Electrostatic storage ring (projection) [216]
- DM comagnetometer (projection) [205]
- CASPEr-gradient (projection) [234]
- Superfluid helium-3 HPD (projection) [253]
- MnCO3 (projection) [254]

5 Axion-EDM

- Axinovae [255]
- Beam EDM [256]
- BBN (dark matter) [257]
- CASPEr-electric [258]
- nEDM [238]
- HfF⁺ [259]
- I_2^+/Ca^+ [260]
- JEDI [245]
- Rb/Quartz [261]
- SN1987A [262]
- *Planck*+BAO thermal axion bound [263]
- CASPEr-electric (projection) [264]
- Storage Ring EDM (projection) [264]
- Polarisation haloscope (projection) [265]

6 Axion-top

Axion-top coupling limits originally compiles in Ref. [266]

7 Axion mass versus f_a

- BBN (dark matter) [257]
- Beam EDM [256]
- Binary pulsars and Solar core constraint on $\bar{\theta}$ [267]. I include minor numerical corrections made by [268, 269].
- GW170817 [270]
- HfF⁺ [259]
- Rb/Quartz [261]
- JEDI [245]
- nEDM [238]
- Tritium decay [271]
- Piezoaxionic effect (projection) [272]
- *Planck*+BAO thermal axion bound [263]
- SN1987A [262]
- Neutron stars (projection) [267].
- NS-NS and NS-BH Inspirals (projection) [267].
- White dwarfs [273]
- Polarisation haloscope (projection) [265]
- Neutron star cooling [274]

7.1 Black hole superradiance

- Baryakhtar et al. [275] (just Stellar mass BHs)
- Mehta et al. [275] (Stellar mass and SMBHs)
- Stott [276]
- Ünal et al. [277] (Quasars)
- Hoof et al. [278]
- Cardoso et al. [279] (dark photon)

8 Axion theory predictions

8.1 Post-inflation QCD axion

- Ballesteros et al. [280]
- Buschmann et al. 2020 [281]
- Buschmann et al. 2021 [282]
- Bonati et al. [283]
- Borsanyi et al. [284]
- Berkowitz et al. [285]
- Dine et al. [286]
- Petreczky et al. [287]
- Fleury & Moore [288]
- Klaer & Moore [289]
- Gorghetto et al. [290]
- Saikawa et al. (2019) [84]

- Saikawa et al. (2024) [291]
- Beyer et al. (2023) [292]
- Kim et al. (2024) [293]

8.2 Other dark matter predictions

- ALP Cogenesis [294]
- Early matter domination [295]
- Post-inflation ALP misalignment [296, 297]
- Trapped misalignment (\mathcal{Z}_N axion) [268]

9 CP-violating couplings

Combined constraints [298]

Scalar-nucleon

- Red giants [299]
- MICROSCOPE [300].
- Eot-Wash [301, 302, 303]
- Irvine [304]. Corrected to 2σ limit by [305]
- HUST [306, 307, 308, 309].
- Stanford [310]
- IUPUI [311].
- Wuhan [305]

Pseudoscalar-electron

- Red giants [299]
- Eot-wash [312]
- e^+e^- Penning trap [313]
- NIST [314]
- SMILE [315]
- Perihelion shift [316]
- QUAX [317, 318, 319]
- Washington [207, 320].
- XENON1T [321]
- ACME (projection) [322]
- Magnon (projection) [219]
- QUAX (projection) [317].

Pseudoscalar-nucleon

- Neutron star cooling [247]
- Hefei (Earth) [323]
- Hefei (mm) [324]
- Washington [325]. Limit taken from [326].
- SMILE [315].
- Mainz [327]
- Moon/Sun [328]
- Yb trap (projection) [322]
- ARIADNE (projection) [329]
- CASPER-wind (projection) [264]
- DM comagnetometer (projection) [205]
- Fifth force Ne-Rb-K comagnetometer (projection) [330]

10 Scalars

Scalar-photon

- Globular clusters [113]
- Eot-Wash (EP) [331]
- Fifth force [332, 333, 334, 335]
- MICROSCOPE [300]
- AURIGA [336]
- BACON [337]
- Cs/Cav [338]
- DAMNED [339]
- Dy/Dy [340]
- Dy/Quartz [261]
- Dynamic Decoupling [341]
- GEO600 [342]
- LIGO O3 [343], see also [344]
- Holometer [345]
- H/Quartz/Sapphire [346]
- PTB (Yb+, Sr clock) [347]
- I₂ [348]
- Rb/Cs [349]
- Sr/Si [350]
- Yb/Sr [351]
- AEDGE (projection) [352]
- AION (projection) [352]
- DUAL (projection) [353]
- MAGIS (projection) [354]
- Nuclear clock (projection) [355]
- Mechanical Resonators (projection) [356]

Scalar-electron

- Red giants [299]
- White dwarfs [357]
- Eot-Wash (EP) [331]
- Fifth force [332, 333, 334, 335]
- MICROSCOPE [300]
- AURIGA [336]
- Cavities [358]
- Cs/Cav [338]
- DAMNED [339]
- GEO600 [342]
- Holometer [345]
- H/Quartz/Sapphire [346]
- LIGO O3 [343], see also [344]
- I₂ [348]
- H/Si [350]
- Rb/Quartz [261]
- Yb/Cs [359]
- NANOGrav 15-year PTA [360]
- FOCOS (nuclear clock projection) [361]
- AEDGE (projection) [352]
- AION (projection) [352]
- DUAL (projection) [353]
- HELIOS (projection) [362]
- Optical microwave clock (projection) [363]
- Optical cavities [364]
- SrOH [365]
- Mechanical Resonators (projection) [356]
- IPTA (mock data) [366]

- Torsion balance (projection) [382]
- STE-QUEST (projection) [383]

11 Vectors

B-L coupling

- Casimir [367, 368, 369]
- Eot-Wash (EP) [370]
- Eot-Wash (ISL) [371]
- MICROSCOPE [372]
- DM stability [373]
- Horizontal branch [374]
- Red giant [374]
- Sun [374]
- Eot-Wash (DM) [375]
- LIGO (O1) [376]
- LIGO/VIRGO [376]
- LISA Pathfinder [377, 378]
- PPTA [379]
- Asteroids (projection) [380]
- HELIOS (projection) [362]
- LISA (projection) [380]
- MAGIS (projection) [354]
- Optomechanical membranes (projection) [381]
- SKA (projection) [382]

12 Dark photons

Combined constraints [384]

SM photon-DP transitions

- Coulomb [385, 386, 387, 388, 389],
- Plimpton & Lawton's experiment [390, 389]
- Atomic spectroscopy [391]
- Atomic force microscopy (AFM) [389]
- Static magnetic field of the Earth [392, 393, 394]
- Static magnetic field of Jupiter [395, 394].
- Jupiter B-field/Juno mission [396]
- ALPs [74]
- ALPS-II (projection) [397]
- SPring-8 [398]
- UWA-LSW [399, 400]
- ADMX-LSW [401]
- CROWS [78].
- DarkSRF [402]
- DarkSRF (projection) [403]
- TEXONO [404]
- Crab nebula [405]
- COBE and FIRAS [406]
- STAX (projection) [407]

Production in stars

- CAST [408]
- SHIPS [409]
- HINODE [410]
- IAXO (modified for longitudinal mode) [411]
- New globular cluster bound [412]
- Old stellar bounds: Solar-L, HB and RG stars [374] (see also [413])
- Neutron stars [414]
- Solar neutrinos [415]
- XENON1T [416]

Dark matter cosmology/astro

- Arias et al. [296]
- Witte et al. [417, 418]
- Caputo et al. [419, 406],
- ISM [420],
- Leo T dwarf [421]
- Gas clouds [421, 422]
- JWST [423]
- Parker Solar Probe [424]
- Planck + unWISE [425]
- INTEGRAL [426]

Dark matter experiments

- Reinterpreted axion limits [384]
- APEX [427]
- ALPHA [55]
- AMAILS [428]
- BRASS-p [429]
- BREAD (projection) [58]
- Dandelion (projection) [430]
- DarkSide-50 [202]
- DAMIC [431]
- Dark E-field Radio [432, 433]
- DM Pathfinder [434]
- DOSUE-RR [435, 436]
- FAST Radio antenna [437]
- FUNK [438]
- GigaBREAD [439]
- MADMAX [440]
- LAMPOST [441]
- LOFAR (solar corona) [442]
- MuDHI [443]
- ORGAN [444, 33]
- ORPHEUS [445]
- QUALIPHIDE [446]
- Quantum cyclotron [447]
- SENSEI [448]
- SHUKET [449]
- SuperCDMS [450]
- SuperMAG [451, 452, 45]

- SQuAD [453],
- SQMS [454],
- SUPAX [455]
- SRF scanning [456]
- Tokyo dish antennae experiments [457, 458, 459]
- WISPDMM [460]
- XENON(100,1T,nT) [461, 321, 462, 463, 416, 464].

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