## **Spin-dependent exotic interactions**

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Novel interactions beyond the four known fundamental forces in nature (electromagnetic, gravitational, strong and weak interactions), may arise due to "new physics" beyond the standard model, manifesting as a "fifth force". This review is focused on spin-dependent fifth forces [1] mediated by exotic bosons such as spin-0 axions and axionlike particles and spin-1 Z' bosons, dark photons, or paraphotons. Many of these exotic bosons are candidates to explain the nature of dark matter and dark energy, and their interactions may violate fundamental symmetries. Spin-dependent interactions between fermions mediated by the exchange of exotic bosons have been investigated in a variety of experiments, particularly at the low-energy frontier. Experimental methods and tools used to search for exotic spin-dependent interactions, such as atomic comagnetometers, torsion balances, nitrogen-vacancy spin sensors, and precision atomic and molecular spectroscopy, are described. A complete set of interaction potentials, derived based on quantum field theory with minimal assumptions and characterized in terms of reduced coupling constants, are presented. A comprehensive summary of existing experimental and observational constraints on exotic spin-dependent interactions is given, illustrating the current research landscape and promising directions of further research.

## References

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