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Radical-pair Based Avian Magnetoreception: Robustness and Optimality MARIA PROCOPIO, THORSTEN RITZ, University of California, Irvine — Behavioural experiments suggest that migratory birds possess a magnetic compass sensor able to detect the direction of the geomagnetic. One hypothesis for the basis of this remarkable sensory ability is that the coherent quantum spin dynamics of photoinduced radical pair reactions transduces directional magnetic information from the geomagnetic field into changes of reaction yields, possibly involving the photoreceptor cryptochrome in the birds retina. The suggested radical-pair based avian magnetoreception has attracted attention in the field of quantum biology as an example of a biological sensor which might exploit quantum coherences for its biological function. Investigations on such a spin-based sensor have focussed on uncovering the design features for the design of a biomimetic magnetic field sensor. We study the effects of slow fluctuations in the nuclear spin environment on the directional signal. We quantitatively evaluate the robustness of signals under fluctuations on a timescale longer than the lifetime of a radical pair, utilizing two models of radical pairs. Our results suggest design principles for building a radical-pair based compass sensor that is both robust and highly directional sensitive.

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