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Eliminating inertia of a stochastic microswimmer with constant speed

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An often used model for an active entity is the two dimensional stochastic microswimmer. It moves due to a propulsive mechanism with constant speed and changes the direction due to deterministic and random torques. Despite the simplicity, the model it is not an overdamped situation. Intertia is reflected by an initial ballistic behaviour. Only after an crossover time being the relaxation time of the orientational directions the motion becomes normally diffusive characterized by a diffusion coefficient.

In the report I discuss the properties and the distribution of displacements of the stochastic microswimmer with constant speed. Various situations with several random torques like Gaussian white noise, an Ornstein-Uhlenbeck process and alpha-stable noise will be studied. Special attention is devoted to the adiabatic elimination of inertia in the model and the derivation of the overdamped limit. It results for all types of random torques in a Gaussian simplification similar to a Brownian particle driven by white noise. Therein the noise intensity addresses the specific noise sources.

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