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Soliton mediated long-range electron transport in Donor–Biopolymer–Acceptor systems

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Biopolymers demonstrate unique physical properties and are widely used in modern nanotechnologies long molecular bridges in Donor – Acceptor systems. There are numerous experimental evidences of the long-range electron transport in such systems.

Here we show that the mechanism of the long-range transport can be based on the soliton formation in biopolymers. It is shown that there exists a broad interval of the parameters for which an electron initially located on the donor, tunnels onto the chain where it forms a soliton-like state, which then travels to the opposite end, where it is captured by the acceptor. It is shown that the efficiency of the electron transport from the donor to the acceptor can reach 90%. Obtained results explain difference of charge transport efficiency in systems “Small Donor – Long Polymer” and “Long Polymer – Acceptor”.

These results explain also highly efficient long-range donor-acceptor electron transport in redox reactions in photosynthesis and cellular respiration in biological systems.

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