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NON-TRADITIONAL PATHWAYS OF EXTRATERRESTRIAL FORMATION OF PREBIOTIC ORGANIC SUBSTANCES.

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Several new mechanisms of chemical reactions in solid phase found and investigated since early 70-s may have direct connections to the prebiotic evolution, in particular to the extraterrestrial scenario of such evolution.
Discovery of molecular tunneling by the example of radiation-induced polymerization of formaldehyde demonstrated the existence of non-vanishing chemical reactivity even near the absolute zero and allowed to put forward the hypothesis of cold prehistory of life. Crucial structural property of the bioorganic world is its homochirality. Very cold solid environment hinders racemization and stabilizes optical activity under conditions typical for outer space.
The revealing of many amino acids in meteorites and reports about non-racemity and enrichment by ^{13}C of some of them increases an interest to the question whether amino acids can be delivered intact to the Earth by a large impactor. There are described the experiments which have demonstrated that shock waves with amplitudes

as much as 50 GPa need not destroy amino acids but can even initiate their condensation into oligopeptides.

Treatment of interstellar and cometary dust grains as hypothetical stages of prebiotic evolution includes the consideration of possible explosions of grains at overcritical concentrations of accumulated active centers. Totality of experimental data and theoretical approaches lead to the conclusion that such explosions are rather of purely thermal than of thermal-wave (thermal-chain) nature.

There are presented formulas which describe thermal behavior of dust grains under the UV exposure - for the cases of stationary regimes and of oscillations of grain temperature and concentration of accumulated radicals.

Peculiar new type of explosive processes - mechanochemical explosions - was disclosed and explained. It is based on the positive feedback between the brittle fracture of irradiated vitreous and polycrystalline samples and the stimulation of chemical reactions at the surface of formed cracks. Initial fracture produces autowave propagation of the reaction front along the sample with a rate much above that of heat transfer but much below the sound velocity.