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INVESTIGATION OF CHEMISTRY OF HYDROGEN, HELIUM AND LITHIUM MOLECULAR IONS IN THE EARLY UNIVERSE

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Abstract. In the age of precision cosmology, determining the chemical composition of the early Universe necessitates a precise assessment of the reaction rates of the primary chemical processes involved. To follow the collapse of primordial clouds and afterwards examine the birth of first-generation stars, a comprehensive chemical-kinetic model for the evolution of the homogeneously expanding Universe in the post-recombination epoch is also required. Models of the early Universe stated that the chemical composition of the primordial gas includes lithium, hydrogen, and helium molecular ions e.g. LiH^+, H_2^+, HeH^+. Abundances and processes (recombination, destruction, etc.) involving such species play an important role in chemistry and evolution of the early Universe, and the science community requires precise data sets for modeling. Radiation from these atomic and molecular species provides us with knowledge about the early Universe's environment. Understanding the relevant atomic and molecular processes is required to accurately interpret this radiation (Albert et al. 2020, Srećković et al. 2020, Vujčić et al. 2023). Here we calculated, recombination/ionization cross sections and rate coefficients, about such systems involving lithium, hydrogen and helium molecular ions. The result is a dataset for the chemistry of the early Universe and various astrophysical and laboratory studies.

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References

Albert, D et al: 2020, *Atoms*, **8(4)**, 76.
Srećković, V. A., Ignjatović Lj. M., Dimitrijević M. S.: 2020, *Molecules* **26.1**, 151.
Vujčić, V. et al.: 2023, *Phys. Chem. Chem. Phys.*, **25(40)**, 26972.