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[Abstract]

New molecular data for planet formation chemistry and modeling

Srećković, V.A[1]., Pop, N[2]., Vujčić, V[3]., Christova, M.D.[4], Iacob, F[5]., Langović M.[1] and Mijić, Z[1]

[1]Institute of Physics Belgrade, University of Belgrade, Pregrevica 118, Belgrade, Republic of Serbia ORCID number: 0000-0001-7938-5748, 0000-0002-6979-377X, 0000-0002-7785-4456
[2]Politehnica University of Timisoara, Timisoara, Romania ORCID number: 0000-0002-7051-6753
[3]Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia ORCID number: 0000-0002-0525-1197
[4]Department of Applied Physics, TU Sofia, Bulgaria ORCID number: 0000-0002-6851-5436
[5]West University of Timișoara, Vasile Părvan Boulevard, 300233, Romania ORCID number: 0000-0002-6979-377X

[*]Correspondence: vlada@ipb.ac.rs

Abstract: Astrochemical models play a crucial role in interpreting studies of interstellar and circumstellar molecules, providing insight into the gas's physical properties and evolution. Advances in astrochemical models are linked to changes in databases and rate coefficient estimations, both experimental and theoretical (see e.g. Iacob et al. 2019; Albert 2020; Srećković et al. 2022; Srećković et al. 2023; Vujčić et al. 2023). The science community requires access to preferred molecular data for modeling and understanding the chemistry of planet formation. Atomic and molecular datasets, such as VAMDC, are essential for developing models and simulations. The examination of studied rates offers useful insights into the occurrence of species. Research should focus on both radiative and concurrent

processes involving molecular ions, including dissociative recombination. Our goal is to calculate, evaluate, and analyze cross sections and rate coefficients for molecular ions like hydrogen and helium using different model parameters.

Keywords: data, modeling, planets

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References

Albert, D, et al. 2020, A decade with VAMDC: Results and ambitions, *Atoms* 8.4, 76.

Vujčić, V, Marinković, BP, Srećković, VA, Tošić, S, Jevremović, D, Ignjatović, LM... & Mason, NJ 2023, Current stage and future development of Belgrade collisional and radiative databases/datasets of importance for molecular dynamics, *Physical Chemistry Chemical Physics*, 25(40), 26972-26985.

Iacob, F, Pop, N, Mezei, JZ, Epée, ME, Motapon, O, Niyonzima, S, ... & Schneider, IF 2019, Recombination and excitation of molecular cations with electrons: Application to H 2+, BeD+ and BeT+, In *AIP Conference Proceedings* (Vol. 2071, No. 1, p. 020007). AIP Publishing LLC.

Srećković, VA, Ignjatović, LM, Dimitrijević, MS, Vujčić, V, Malović, M, Jevremović, D, ... & Klyucharev, AN 2023, The Rydberg atom-atom collisions: Chemi-ionization cross-sections and rate coefficients in alkali-metal astrophysical and low-temperature laboratory plasmas, *Advances in Space Research*, 71(2), 1245-1251.

Srećković, VA, Ignjatović, LM, Kolarski, A, Mijić, ZR, Dimitrijević, MS, & Vujčić, V 2022, Data for Photodissociation of Some Small Molecular Ions Relevant for Astrochemistry and Laboratory Investigation, *Data*, *7*(9), 129.