Contribution ID: **1993** Type: **Oral**

# Coulomb Corrections in Rare B-Decays: A Key to Improved Precision

*Tuesday 28 October 2025 12:45 (15 minutes)*

We present a systematic analysis of Coulomb corrections for the interaction of charged leptons in the final state in lepton and semi-lepton decays of neutral $B$-mesons. The calculation is performed within the Furry picture. For scalar systems, a comparison is made between the nonrelativistic Gamow-Sommerfeld-Sakharov approximation, the exact relativistic method of Crater-Alstine-Sazdjian, and the Furry approach. Based on this comparison, an assumption is made about the applicability of the Furry method for calculating Coulomb corrections in the considered $B$-meson decays. The corrections are applied to the analysis of lepton ($B^0_{d,s} \to \ell^+\ell^-$) and semi-lepton ($B^0_{d,s} \to h^0\,\ell^+\ell^-$, $B^0_{d,s} \to V^0\ell^+\ell^-$) channels. Differential and angular distributions and partial decay widths are calculated.

For the $B^0_s \to \mu^+\mu^-$ channel, Coulomb corrections improve the prediction of the partial width by 2%, improving the agreement with the LHCb/CMS experimental results within the current experimental (11%) and theoretical (5% lattice QM) errors. In the decays $B^0 \to K^0\mu^+\mu^-$ and $B^0 \to K^{*0}\mu^+\mu^-$, Coulomb effects also reduce the discrepancies between theoretical predictions and experimental data (to less than 1% and from 11% to 4% respectively). Finally, for the decays $B^0_{d,s} \to \{h^0, V^0\}\,\tau^+\tau^-$, the Coulomb correction reaches 7\%, which is comparable to the uncertainties of the non-perturbative contributions of the strong interaction. The latter result suggests that the Coulomb correction may become significant in the search for new physics in rare $B$-meson decays, especially those involving $\tau$-leptons in the final states.

**Authors:** MANUKHOV, Stepan; NIKITIN, Nikolay (Lomonosov Moscow State University)

**Presenter:** MANUKHOV, Stepan

**Session Classification:** Theoretical Physics

**Track Classification:** Theoretical Physics