January 30, 2026

Editor-in-Chief
ACS Physical Chemistry

Dear Editor,

We are pleased to resubmit our manuscript entitled *"Magnetic Anisotropy and Spin Coupling in a Cobalt(II) Dimer with Bioinspired Bridges"* for consideration in *ACS Physical Chemistry*.

Cobalt(II) coordination complexes constitute a versatile platform for investigating how coordination geometry and spin–orbit coupling determine magnetic properties. Although numerous Co(II) systems have been reported in recent literature, only a limited number present a comprehensive and quantitatively reliable magnetic characterization. In this context, our work addresses the magnetic behavior of the hexacoordinated cobalt dimer $[\mathrm{Co_2}(\mu{-}L1H)_2(\mu{-}H_2\mathrm{O})_2(\mathrm{H_2O})_4]4\mathrm{NO_3}\cdot 2\mathrm{H_2O}$, where L1H denotes an adenine bridging ligand.

The hexacoordinated environment stabilizes a high-spin $S = 3/2$ configuration for both Co(II) centers, resulting in strong spin–orbit coupling and significant zero-field splitting, described by axial (D) and rhombic (E) anisotropy parameters. Fits to magnetic susceptibility and magnetization data reveal antiferromagnetic coupling between the Co(II) ions, with an anisotropy ratio $E/D \approx 1/4$ and $D/k_B = 89$ K, evidencing pronounced magnetic anisotropy. This behavior is further supported by anisotropic Landé factors, with $g_x = g_y = 2.5$ and $g_z = 2.4$, consistent with an easy-plane magnetic anisotropy.

By combining experimental magnetometry with a detailed theoretical analysis, our study provides a complete determination of the anisotropy tensor and magnetic coupling parameters of a bioinspired Co(II) dimer. The established correlation between structural features and magnetic anisotropy contributes to a deeper understanding of spin coupling in transition-metal dimers, with implications for molecular magnetism and bioinorganic modeling.

We believe that the results presented in this manuscript are well aligned with the scope of *ACS Physical Chemistry* and will be of interest to researchers working in molecular magnetism, coordination chemistry, and theoretical modeling of magnetic anisotropy. We respectfully submit this manuscript for your consideration and would appreciate the opportunity to contribute to the journal.

Sincerely,

The Autors.