# Magnetic Exchange Based on $\pi$-$\pi$ Stacking Interactions: Synthesis, Crystal Structure, Thermal Decomposition and Magnetic Properties of $[Ce(phen)_2(H_2O)_2(NO_3)_2](NO_3)(phen)_2(H_2O)$

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Reaction of $Ce(NO_3)_3 \cdot 6H_2O$ and 1,10-phenanthroline in $CH_3OH$ / $H_2O$ afforded the title compound $[Ce(phen)_2(H_2O)_2(NO_3)_2](NO_3)(phen)_2(H_2O)$, which consists of $[Ce(phen)_2(H_2O)_2(NO_3)_2]^+$ complex cations, $NO_3^-$ anions, phen and crystal water molecules. Within the $[Ce(phen)_2(H_2O)_2(NO_3)_2]^+$ complex cations, the Ce atoms are 10-fold coordinated by four pyridyl N atoms, four nitrato O and two water O atoms with d(Ce-O) = 2.505 - 2.629 and d(Ce-N) = 2.666 - 2.734 Å. The supramolecular assemblies of the complex cations via $\pi$-$\pi$ stacking interactions form 1D columnar chains, which run parallel to give positively charged 2D layers. The phen molecules are also assembled via $\pi$-$\pi$ stacking interactions into 1D columnar chains whose arrangement results in neutral 2D layers. The $NO_3^-$ anions and the crystal water molecules are situated between the positively charged and neutral 2D layers. The title compound decomposes in four steps upon heating. Magnetic measurements show that it is a ferrimagnet at low temperature and follows the Curie-Weiss law $\chi_m(T - \Theta) = 0.796$ ($cm^3$ $mol^{-1}$ K) with the Weiss constant $\Theta = -57(2)$ K over the temperature range 50 - 300 K. Comparison of the magnetic behavior of the title cerium complex with that of the Pr and Tb phen nitrato complexes of the formula $Ln(phen)_2(NO_3)_3$ (Ln = Pr, Tb) suggests that magnetic exchange is probably transmitted *via* the $\pi$-$\pi$ stacking interactions.