**Synthesis of homonuclear complexes**

The single crystals were obtained by slow evaporation of a solution of the complex from methanol.

The tetrakis lanthanide β-diketonate complex 

\[
[Tb(Tfac)]_4^{2+}
\]

is the main focus. This complex crystallizes in the monoclinic space group P2_1/c. The lanthanide ion is coordinated with four oxygen atoms from four β-diketonate ligands. One sodium atom is present as counter ion.

**Crystal structures**

**Synthesis (co-crystallization) of the heteronuclear complex**

The heteronuclear complex 

\[
[Eu_{3+}Tb_{4+}Sm_{2+}](Tfac)_{12}\text{Na}^+
\]

was synthesized by adding the Eu^{3+}Tb complex and the Tb^{4+}TbCl complex to a methanol solution in a 1:1 ratio and left to stir for 24h. The same synthesis step was applied for different Eu^{3+}Tb^{4+} and Tb^{4+}Sm complexes, just a different ratio was used. Afterwards the solution was left to crystallize by slow evaporation in order to obtain single crystals.

**Temperature-dependent luminescence**

**Conclusion**

We have obtained several new crystal structures with a well-known β-diketonate ligand throughout the lanthanide series. With the synthetic procedure that was used we obtained both the homonuclear complexes as well as heteronuclear complexes. Both types of complexes show luminescence properties in solid state and homonuclear complexes from the visible series also in solution. The heteronuclear Eu^{3+}Tb^{4+} and Tb^{4+}Sm complexes as well as Dy^{3+} complex show good temperature-sensing properties in the physiological temperature range.