

The aim of this work was to develop a methodology for catalytic and potentially enantioselective photoreactions and especially  $\gamma$ -cyclizations.

In the beginning of this work the methodology for photoinduced electron transfer (PET)-initiated cyclizations, catalyzed by organometallic chiral Lewis acids, was developed and the following parameters adjusted: Design of a chiral metal-ligand catalyst and evaluation of the proper PET-reaction conditions (electron donor/acceptor couple, solvent, wavelength of irradiation and light stability of the reaction components).

Then the newly developed methodology was probed in different applications aiming at catalytic and asymmetric PET-triggered cyclizations.

It was shown for the first time that PET-initiated cyclizations can be performed catalytically and enantioselectively.

A potential mechanism of the cyclizations is also discussed in this work.

Possible improvements of the methodology to reach higher enantioselectivity in this type of reactions are proposed.