Enantioselective catalysis of photochemical reactions is a challenge that many groups have faced in recent years. Several approaches have been developed to control the selectivity in the excited state [1]. Among others, it has been shown that chiral Lewis acids can be used to promote enantioselective intra- and intermolecular [2+2] photocycloaddition reactions of enones [2]. However, photocycloaddition reactions of aromatic aldehydes with olefins have not been thoroughly explored. Herein, the intermolecular ortho photocycloaddition reaction of phenanthrene carboxaldehyde (1) was studied, with a focus on the use of achiral and chiral Lewis acids in order to influence the selectivity of the reaction [3].

Without Lewis acids both expected products, the ortho photocycloaddition product rac-2 and the oxetane rac-3 were formed. The addition of Lewis acids led to an extensive bathochromic shift of the absorption band with $\pi,\pi^*$ character and therefore selective excitation of the Lewis acid substrate complex was possible. Irradiation of this complex with visible light led to exclusive population of the $\pi,\pi^*$ state and consequently to the formation of the ortho photocycloaddition product 2 as the only photoproduct.

Currently, the photochemical reactivity of 1-naphthaldehyde and 2-naphthaldehyde with olefins is under investigation. It is known that when irradiated with light of short wavelength, both aldehydes only show reactivity at the carbonyl group [4]. However, there are indications that the aromatic ring can be activated by catalytic amounts of Lewis acids and as a result the type selectivity of photoreactions can be reversed.