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LIGHT-CAT: Light-driven Catalytic Technologies for the Selective Functionalisation of C(sp3)-H Bonds

Metal-catalyzed C(sp3)-C(sp3) Cross-Coupling of Two Abundant Substrates.

One key target of modern chemistry is to convert abundant chemicals into added-value products. While this can be achieved by converting ubiquitous, native functional groups (e.g. carboxylic acids, halides) via cross-coupling technologies, a better approach to molecular construction is the direct functionalisation of carbon–hydrogen (C–H) bonds (the most abundant moiety in organic molecules). However, it is challenging to achieve C(sp^3)–H bond functionalisation with control over site selectivity and without the assistance of directing groups. The LIGHT-CAT project, that is granted by PRIN2022 (grant number P2022RHMCM) aims to identify sustainable and innovative catalytic techniques driven by light to enable one-step access to complex molecules directly from readily available C-H substrates (including chemical feedstocks and natural products) through selective C-H functionalisation at sites that are unreactive for traditional methods. To achieve this, we will use photocatalytic Hydrogen Atom Transfer (HAT) processes to selectively target strong unactivated C(sp^3)–H bonds. For example, we will use the rich photochemistry of tetrabutylammonium decatungstate (TBADT), a polyoxometalate widely used as an efficient HAT photocatalyst. Upon light excitation, TBADT can form radicals upon H-abstraction from unactivated C–H bondst. The new methods will offer innovative tools for unlocking inaccessible reaction pathways, thus enabling the preparation of previously difficult-to-make molecules.

For the research position, we are looking for candidates with a strong background in radical chemistry, particularly in Hydrogen Atom Transfer (HAT) processes. Additionally, candidates should have a research background of at least three years within an established research team, ideally in an international environment. Experience in enantioselective radical chemistry, photochemistry, and radical mechanistic investigations will be highly regarded. These competencies are crucial for effectively advancing the first work package (WP1) of the LIGHT-CAT project, which focuses on the ***Metal-catalyzed C(sp3)-C(sp3) Cross-Coupling of Two Abundant Substrates***.