Title: Photophysical Properties of Carbene-Protected Chemically Precise Nanoclusters

In order to solve the complex issues facing cancer treatment today, it is necessary to consider alternatives to traditional medical molecules and include novel innovative therapeutic materials. Nanoclusters are an emerging class of nanomaterials, known for their unique optical and photophysical properties. Comprised of a metal core surrounded by protecting ligands, nanoclusters are distinct from the more extensively studied nanoparticles due to their exact molecular formulas. Nanoclusters are smaller than plasmonic nanoparticles, and far more similar to molecules due to their quantum confinement and distinct electronic transitions, making them a unique substitution in fields that traditionally rely on molecules.

The structure of nanoclusters is highly tunable: changing the ligand, the metal core, or the size of the cluster will each change the electronic states. As a result, these differences between clusters can be probed through optical techniques to understand the unique photophysical properties of each cluster. In selecting the strongest candidates for therapeutic applications, the structure/property relationship must be well understood in order to design a nanocluster to maximize desired features.

In this work, we explore the photophysical properties of a series of carbene-protected nanoclusters for use in medical therapies. Through elucidating the excited state dynamics, the qualities of a superior candidate will be discussed and future directions explored.