Organic small molecule semiconductors are very promising for various applications ranging from flexible electronics (such as roll-able LEDs) to photovoltaics. Controlling and optimizing the electronic properties has been identified as a grand challenge of materials research in the near future. Specifically, one of the recurring themes in government workshops and documents that identify “grand challenges” in materials research for years to come has been the issue of controlling and optimizing the fundamental properties of materials known as excitonic properties\(^1\). To further our understanding of these organic molecules, varying aromatic ring sizes and central atom substitutions are manipulated via synthetic chemistry techniques, in order to control and optimize these properties.

In this particular study, the electronic properties of three molecules within the phthalocyanine family were explored: Tetraphenylporphyrin, Phthalocyanine, and Naphthalocyanine. The electronic properties specifically looked are related to excitons, which are a pairing of an electron in its excited state and an empty hole left in the ground state. To probe these molecules, organic thin films were fabricated using a pen-writing technique developed here at UVM. Historically, this technique has been very successful in producing high quality crystalline organic thin films suitable for spectroscopy techniques\(^2\). The excitonic properties in these thin films were then explored using photoluminescence and linear dichroism methods. In studying the three molecules, it was found that with an increase in aromatic ring size, that the excitonic relaxation time between the electron and its corresponding hole decrease and that there is a noticeable red shift in the photoluminescence measurements.

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