Your assignment is to present to the class the following paper: “Air-stable thermoluminescent carbodibarbene-borafluorenium ions” (https://pubs.acs.org/doi/10.1021/jacs.1c11861). You are provided the manuscript as well as the supporting information. Below are questions similar to those you are used to from literature discussions this semester. You should use these to guide the construction of your presentation. Make sure that you provide a background on the field generally. The questions below are useful for guiding this, may not be comprehensive (i.e., you may delve into areas not directly addressed by the questions). Questions may not necessarily be in the order in which topics should be presented. When a technique that is new to you is employed, you should assume that it is new to the rest of the class as well, and briefly explain it. You are encouraged to use figures. You may copy/paste figures from the materials provided, or from other sources in the interest of time. Ensure that any figure not generated by you or from this manuscript has a citation. You are encouraged to reach out to Prof. Farrell for help. However, you should first put a reasonable amount of effort into answering your questions yourself by doing your own research.

The objective of this assignment is to enhance your skills of reading and digesting scientific literature, as well as exposing the class to an area of research we are not able to cover in one semester of this course.

1. Give some background:
   1. What is a borenium ion?
   2. What is the molecule fluorene? What is a borofluorenium?
   3. What do the authors hope to achieve with boreniums here?
   4. Carbenes:
      1. What are *N*-heterocyclic carbenes?
      2. What are carbones?
2. Synthesis and characterization:
   1. Describe the synthesis of **2** and **3**?
      1. What is “slow diffusion”? How was it done here to grow crystals?
   2. Describe how these compounds were characterized, both structurally and spectroscopically. Provide and show important details.
      1. Ensure you include 11B NMR.
      2. Delve specifically into the broadening of 1H NMR signals of the methyl group. Define an “agostic” interaction, and again highlight Lewis Acid/Base chemistry to propose why this happens.
      3. Discuss variable temperature (VT) NMR.
   3. Describe the bonding. Include discussions of Lewis Acid/Base chemistry.
3. Reactivity:
   1. Why is the methyl group easily deprotonated to generate compound **4**?
   2. What spectral features of **4** indicate that it is different than its precursor?
4. Density Functional Theory Calculations:
   1. Discuss the nature of the HOMO and LUMO. What might this imply for reactivity?
5. Discuss the fluorescence of these compounds
   1. What is quantum yield?
   2. What is thermoluminescence, and how is it observed here? Why is it important that something like these small molecules do thermoluminescence?
6. Conclude with some big picture take-aways from this paper.
   1. What concepts from this course did you need to consider?
   2. What is the big achievement that warrants publication in *Journal of the American Chemical Society*, a high impact journal?