Novel materials are required to make fundamental and applied advancements over a broad range of applications. While traditional materials synthesis relies on thermochemical methodologies, i.e., using temperature to overcome activation energy barriers and stimulate chemical bond rearrangement at ambient pressure, high-pressure synthesis methods show promise to create novel materials with superlative properties and give access to an entirely new materials space. In this talk I will provide a general overview of how high pressure (one thousand to one million times atmospheric pressure) can be used to create new materials and provide insights into novel phenomena. Specifically, I will discuss our recent discoveries of new silicon allotropes with enhanced optoelectronic properties and novel carbon-based clathrate structures with tunable electronic structures.

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