Modern electronics manufacturing requires the use of lasers for a wide range of processes, and solar cells are no exception. Lasers offer many appealing advantages including increased throughput, precision, and design flexibility. The large-scale implementation of lasers in manufacturing has been supported by significant advances in laser systems in terms of cost, durability, and reliability – they have demonstrated that they are robust shop tools. The configurability of laser systems over orders of magnitude of wavelengths, pulse durations, and intensities provide significant opportunities for innovative solar cell processing techniques. Matching this opportunity is the need for creativity followed by laboratory research to imagine and develop these techniques.

In this talk I will present an overview of current production-scale laser processes in solar cell manufacturing. Then, I will present several examples of laser processes that have been pursued as a part of my research over the past several years. This includes a process for back contact formation in CdTe thin film solar cells made by an ultraviolet nanosecond pulsed laser. I will also discuss how lasers can be used for dopant activation in both Si quantum dots and bulk wafer silicon. These effects are demonstrated using very different approaches from a short UV laser pulse for the quantum dots and a high-power continuous wave laser in bulk silicon.