Copper Halide Semiconductors for Room Temperature Quantum Applications – A Materials Perspective

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A relatively unexplored region of the spectrum for the new science and technology of quantum manipulation of light and matter lies in the blue/ultraviolet (UV) spectral region (350-450 nm).

Since the 1960s, research work in copper halides (CuCl, CuBr, CuI) has tended to focus on their exciting nonlinear optical properties, yet progress has been hampered by the inability to grow device quality electronically doped materials, and electrical contacts to these. Recent breakthroughs by DCU researchers we have proved the concept that both N-type and P-type CuCl and CuBr can be grown. Simple PN device structures have been proven and recent simulation work suggests that it may now be possible to develop efficient electrically pumped copper halide optical emitters. We will discuss the way forward towards the development of ultralow power blue/UV light emitters. These devices could be capable of excitonic and polaritonic emission, and biexcitonically mediated quantum entanglement, based on advances in copper halide materials development and their incorporation into novel microcavity structures.