

# Creating and detecting ultra-long-range Rydberg molecules and their ghosts

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Recent developments relating to our understanding and control of ultra-long-range Rydberg molecules will be presented, including the trilobite and butterfly long range molecules with extremely large (kilodebye) electric dipole moments. Recent and ongoing experimental explorations of these unusual molecules will also be summarized. Their properties enable the formation of self-organized 1D lattices, for instance, owing to the Rydberg dipole blockade effect. Another unusual aspect of the high degeneracy of the excited Rydberg state Hilbert space [1] is that through coherent application of field pulses, it should be possible to create a ghost trilobite or butterfly chemical bond.

[1] M. T. Eiles, Z. Tong, and C. H. Greene, arXiv:1806.02963 (2018).