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2D Self-Assembled Crystals with Polar Molecules

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We discuss the possibility to control the strength and design the shape of the long-range part of the interaction potentials of bosonic polar molecules using static and microwave fields. The dressing of rotational excitations combined with low dimensional trapping provides novel tools to engineer strongly correlated quantum phases, which we study utilizing recently developed quantum Monte Carlo techniques. As an example, we show that intermolecular dipole-dipole interactions can drive the system from a superfluid to a *self-assembled* crystalline phase, which has never been observed so far with cold molecular or atomic gases.