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Time-reversal-breaking and d-wave superfluidity of ultracold dipolar fermions in optical lattices[1] CARLOS SÁ DE MELO, LI HAN, Georgia Institute of Technology — We describe possible superfluid phases of ultracold dipolar fermions in optical lattices for two-dimensional systems. Considering the many-body screening of dipolar interactions at larger filling factors, we show that several superfluid phases with distinct pairing symmetries naturally emerge in the singlet channel: local s-wave (sl), extended s-wave (se), d-wave (d) or time-reversal-symmetry breaking ($sl + se \pm id$)-wave. The temperature versus filling factor phase diagram indicates that d-wave is favored near half-filling, that ($sl + se$)-wave is favored near zero or full filling, and that time-reversal-breaking ($sl + se \pm id$)-wave is favored in between. When a harmonic trap is included a sequence of phases can exist in the cloud depending on the filling factor at the center of the trap. Most notably in the region where the ($sl + se \pm id$)-wave superfluid exists, spontaneous currents are generated, and may be detected using velocity sensitive Bragg spectroscopy.

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