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Phase-modulated superfluids of bosons in spin-orbit coupled optical lattice YINYIN QIAN, MING GONG, The University of Texas at Dallas, VITO SCAROLA, Virginia Tech, CHUANWEI ZHANG, The University of Texas at Dallas — We study the phase diagram of spin-orbit coupled ultra-cold bosons in a square lattice using the Gutzwiller method. In the superfluid regime, we show that the interplay between spin independent and spin-dependent tunnelings may give rise to a few different types of phase-modulated superfluids. The transitions between different superfluids are found to be the first-order. We investigate the rich periodic structure of the phases of the superfluids, which may be directly probed using the spin structure factor. Different types of superfluids may also possess different excitation spectra.

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