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Experimental investigation of spin-orbit coupled BECs¹

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Ultracold atomic gases provide a powerful tool to study the physics of artificial gauge fields and complex Hamiltonians. In this context, the implementation of spin-orbit coupling is an advancement that is currently met with great interest, both theoretically and experimentally. In our lab we have implemented spin-orbit coupling by using a Raman dressing scheme. Our recent experiments with spin-orbit coupled Bose-Einstein Condensates (BECs) include the observation of quantum quench dynamics and Zitterbewegung, upper spin-orbit band dynamics, and an analogy for the Dicke type phase transition. Furthermore, in our experiments we have studied the physics arising from a combination of spin-orbit coupling and a moving optical lattice: by measuring atom loss due to modulational instability in a system composed of a spin-orbit coupled BEC loaded into a moving optical lattice, the dispersion relation of this system can be investigated. This investigation of the band structure is corroborated by matching theoretical results. I will report on the current status of our ongoing investigations.

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