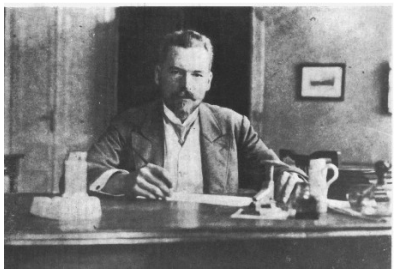

Contribution ID: **48** Type: **Flash talk**

Diffraction and interference with run-and-tumble particles

Tuesday, 28 September 2021 13:35 (5 minutes)

Run-and-tumble particles, frequently considered today for modeling bacterial locomotion, naturally appear outside a biological context as well, e.g. for producing waves in the telegraph process. Here, we use a wave function to drive their propulsion and tumbling. Such quantum-active motion realizes a jittery motion of Dirac electrons (as in the famous Zitterbewegung): the Dirac electron is a run-and-tumble particle, where the tumbling is between chiralities. We visualize the trajectories in diffraction and double slit experiments for electrons. In particular, that yields the time-of-arrival statistics of the electrons at the screen. Finally, we observe that away from pure quantum guidance, run-and-tumble particles with suitable spacetime-dependent parameters produce an interference pattern as well.

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Session Classification: S5