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Roton Minimum in the Excitation spectrum of the $2+1/3$ FQHE State¹ URSULA WURSTBAUER, Walter Schottky Institut TU Munchen, LINGJIE DU, ANTONIO LEVY, ARON PINCZUK, Columbia University, MICHAEL MANFRA, Purdue University, KEN WEST, LOREN PFEIFFER, Princeton University — The physics of low-lying excitations in the second Landau level (SLL) is remarkably different from that in the lowest LL. Our work explores the fascinating excitations in the second Landau level by measurements of low-lying neutral excitation modes in the SLL from resonant inelastic light scattering (RILS) experiments [1,2]. We see clear signatures for gapped modes for several filling factors known from transport to be incompressible FQHE states such as $\nu = 2+2/5$, $2+3/8$ and $2+1/3$, where three modes can be excited by RILS. For $\nu=2+1/3$, a band of a dispersive mode in the range of $0.15 \text{ meV} < \text{EDOS} < 0.35 \text{ meV}$, a mode centered at $E_{\text{gap}} \approx 0.08 \text{ meV}$ and a weak, sharp mode at $E_S \approx 0.1 \text{ meV}$ occur. The first two modes are interpreted as collective charge excitations in good agreement with a pronounced roton minimum and other critical points in the calculated wave-vector dispersion. The third mode is assigned as excitation with spin reversal [2]. Remarkably, all modes exhibit a striking dependence on the filling factor uncovering incompressible quantum states. [1] U. Wurstbauer, et al. Phys. Rev. B. 92, 241407(R) (2015). [2] U. Wurstbauer, et al. Phys. Rev. Lett. 110, 026801 (2013).

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