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Anomalous Energy Gaps of the Odd Denominator Fractional Quantum Hall States in Different Spin Branches of the Second Landau Level ETHAN KLEINBAUM, Purdue University, ASHWANI KUMAR, Monmouth College, MICHAEL MANFRA, Purdue University, LOREN PFEIFFER, KEN WEST, Princeton University, GABOR CSATHY, Purdue University — The nature of the fractional quantum Hall states forming in the second Landau level, including those with odd denominator Landau level filling factors, remain unknown. Conjectures of nonconventional origins have lead to the investigation of several odd denominator states in the lower spin branch of the second Landau level, such as the ones at $\nu=2+1/3$ and $2+2/3$. We report first measurements of the energy gaps in the upper spin branch of the second Landau level at $\nu=3+1/3$, $3+2/3$, $3+1/5$ and $3+4/5$. A comparison of the energy gaps of these states to those of their counterparts in the lower spin branch reveals a surprising reversal in the relative magnitudes of the states at partial filling factors $1/3$ and $1/5$. We explore possible explanations of this unusual observation. The work at Purdue was supported by the DOE BES contract no. DE-SC0006671. K.K. West and L.N. Pfeiffer acknowledge the support of the Princeton NSF-MRSEC and the Moore Foundation.

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