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Laser-Coolable Asymmetric Top Molecules BENJAMIN AUGENBRAUN, Harvard University, IVAN KOZYRYEV, Columbia University, TIMOTHY STEIMLE, Arizona State University, TANYA ZELEVINSKY, Columbia University, JOHN DOYLE, Harvard University — We present a practical roadmap to laser cool asymmetric top molecules, including chiral species [1]. We analyze how the complex rotational and vibrational structure, and the generally relaxed selection rules, affect optical cycling in these species. A diverse class of asymmetric top molecules is identified which can be laser cooled effectively with reasonable experimental complexity. We present vibrational branching ratio measurements for CaSH and CaNH2, two prototypical members of this class of molecules. In addition, calculations of vibrational branching ratios show that over a dozen isoelectronic species are highly favorable for laser cooling. As part of this analysis, we describe methods to achieve rotationally closed optical cycles in these molecules. Potential scientific impacts of these species span frontiers in controlled chemistry, quantum simulation, and searches for physics beyond the Standard Model. [1] B. L. Augenbraun, J. M. Doyle, T. Zelevinsky, and I. Kozyryev, arXiV:2001.11020 (2020)

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