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Three spinors with long-range van der Waals interactions — quantitative predictions for ultracold collisions[1] YUJUN WANG[2], PAUL S. JULIENNE, Joint Quantum Institute, University of Maryland and NIST — We perform three-body calculations for ultracold alkali atoms with multichannel spinor physics built in. By using van der Waals interaction models and allowing each atom to carry spin states, the observed three-body resonant features in ultracold Cs experiments [1] can be well reproduced in our calculations. In particular, we construct two-level and three-level spinor models for each atom, which are adequate for describing three-body physics near isolated Feshbach resonances and strongly overlapping resonances, respectively. The Efimov-related three-body features we reproduce are located near Feshbach resonances with vastly different resonance strengths, and typically have non-negligible shifts from the universal positions predicted for infinitely broad Feshbach resonances. The simplicity of our model, although remarkable in predicting the a new class of universal positions for three-body features, still leaves some nonuniversal signature in their overall magnitude. We discuss the physics behind such properties and the scenarios where nonuniversal aspects can be important.

[1] Kraemer, et al., Nature 440, 315 (2006); S. Knoop, et al., Nature Phys. 5, 227 (2009); F. Ferlaino, et al., Few-Body Sys. 51, 113 (2011).

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