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Geometric phases in classical three-body dynamics FLORENCE J. LIN, University of Southern California — In the classical dynamics of the N-body problem, a geometric phase is meaningful both physically and differential geometrically. Physically, a geometric phase corresponds to a net rotation due to nonzero internal angular momentum (with respect to a moving frame) contributing to the total angular momentum of a system. Differential geometrically, a geometric phase corresponds to a net rotation described by the holonomy of a connection. This result is demonstrated for the dynamics of a moving frame for three-body systems in terms of various coordinates, such as polar Jacobi coordinates, Guichardet coordinates, and the mutual distances between the bodies. In classical molecular dynamics,[1] geometric phases have been physically observed both experimentally and computationally. For example, a geometric phase has been observed experimentally in the rotation of the recoil angle of a departing atom in a dissociating triatomic molecule (a three-body system) due to rotation of the remaining diatomic fragment, and a geometric phase has been observed computationally in the overall rotation of a flexible protein molecule (an N-body system) due to its internal motions.

[1]F. J. Lin, *Discrete and Continuous Dynamical Systems Supplement* **2007**, 655 - 666 (2007).

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