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Deformation of Symmetry and Persistence of Dynamics

We investigate the persistence of local dynamics in Hamiltonian systems under deformation from the Euclidean plane to surfaces of constant curvature. For each fixed sign of curvature, we consider Hamiltonian systems on the sphere or hyperbolic plane, recovering the Euclidean plane as the curvature tends to zero. The deformation of symmetry is described by the Inönü–Wigner contraction of Lie algebras from so(3) or so(2,1) to se(2). Using Riemannian exponential coordinates and a local symplectic slice construction, we establish the persistence of non-degenerate relative equilibria and relative periodic orbits for general cotangent-bundle Hamiltonian systems. We illustrate the results with applications to the Newtonian n-body problem on curved spaces.