1135-70-116 **Corey Shanbrom*** (corey.shanbrom@csus.edu), Department of Mathematics and Statistics, Sacramento State University, 6000 J St, Sacramento, CA 95819, and **Victor Dods** (victor.dods@gmail.com). *Numerical methods and closed orbits in the Kepler-Heisenberg problem.* Preliminary report.

The Kepler-Heisenberg problem is that of determining the motion of a planet around a sun in the Heisenberg group, thought of as a three-dimensional sub-Riemannian manifold. The sub-Riemannian Hamiltonian provides the kinetic energy, and the gravitational potential is given by the fundamental solution to the sub-Laplacian. This system is known to admit closed orbits, which all lie within a fundamental integrable subsystem.

Here, we introduce a computer program which finds these closed orbits. Using Monte Carlo optimization with a shooting method, and applying a recently developed symplectic integrator for nonseparable Hamiltonians, we find approximations to periodic orbits whose existence was known. Moreover, we find new orbits with previously unknown symmetry types, and we encode these symmetry types as rational numbers. These results provide explicit visual representations of partially integrable dynamics with non-compact invariant manifolds. Our codebase is free and open-source. (Received July 28, 2017)