**Exercise(s)** 5. 3. 2015

1. Consider the $N$–body problem in $\mathbb{R}^3$. The (additive) Lie group $\mathbb{R}^3$ acts by simultaneous translation on the configuration space and this lifts to the phase space $\mathcal{P} = T^*(\mathbb{R}^3)^N \cong \mathbb{R}^{6N}$. Explicitly compute the momentum mapping and confirm that symmetry reduction can be performed by fixing the centre of mass at the origin.

2. Consider a particle in a central force field in $\mathbb{R}^3$. The (matrix) Lie group $SO(3)$ acts by simultaneous[1] rotation on the phase space $\mathcal{P} = T^*\mathbb{R}^3 \cong \mathbb{R}^6$. Compute the momentum mapping and reduce the $SO(3)$–symmetry.

[1] of what?