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Particle filters used in data assimilation are nonintrusive in the sense that they do not alter the trajectories of individual ensemble members. For this reason they offer a simple means of preserving geometric features of the dynamics to effect ‘data assimilation on manifolds’. However they suffer from degeneracy of the ensemble, in which all of the ensemble weight gets assigned to a single sample, and have no mechanism for correcting ensemble drift. Thermostats have traditionally been used to perturb trajectories of molecular gases to ergodically sample equilibrium (Gibbs) measures. However they can be easily implemented to preserve additional (e.g. structural) invariants. Recent experience with thermostats also indicates they can be used to sample a nonstationary measures conditioned on data, making them a potential compromise for particle filtering.

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