1 Hamiltonian Monte Carlo, code tests

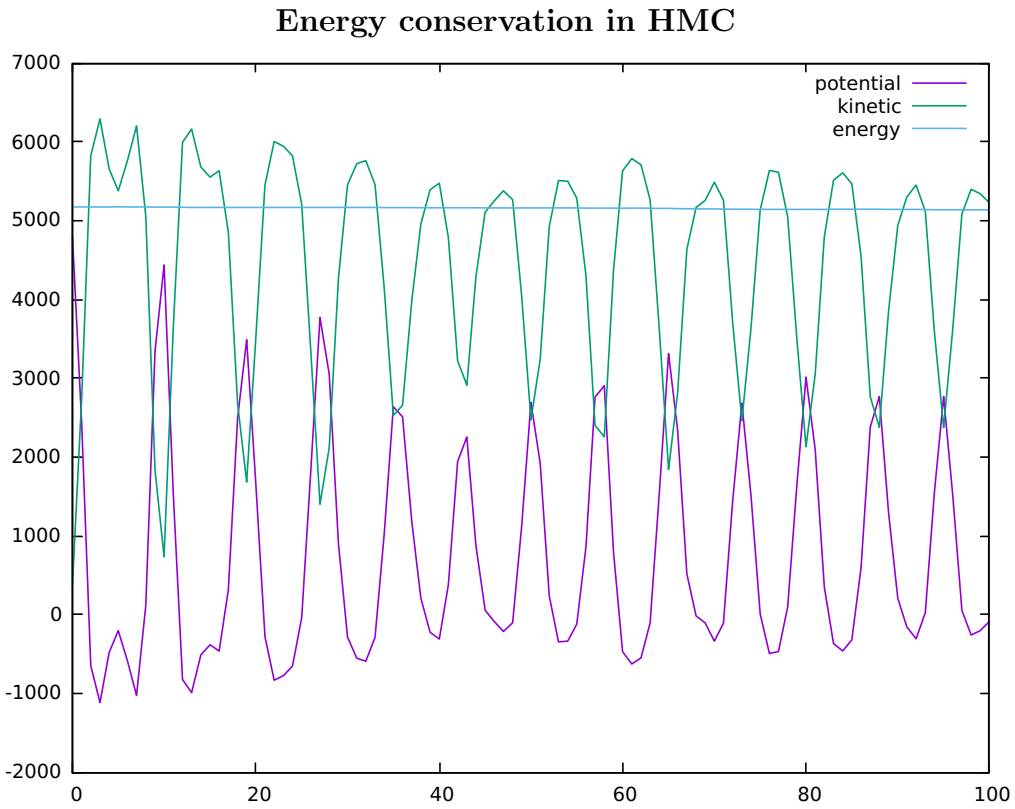

Figure 1: Action, kinetic term and Hamiltonian vs integration step; $(p, q) = (1, 1)$; $n = 20$; $g = -2.5$; $L = 100$; $\tau = 0.0001$; time: 5s.

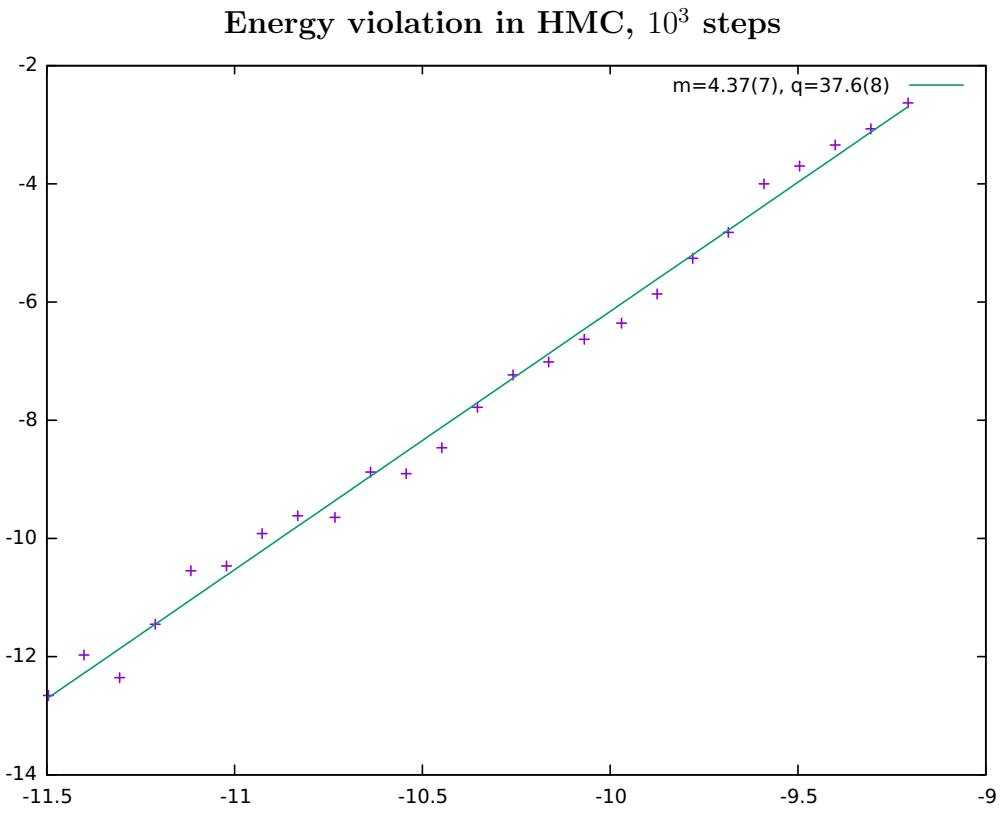

Figure 2: $\log \Delta H$ vs $\log \tau$ (purple): $(p, q) = (2, 0)$; $n = 10$; $g = -2.2431$; $L = 10^3$; Linear fit (green): $m = 4.37 \pm 0.07$, $q = 37.6 \pm 0.8$

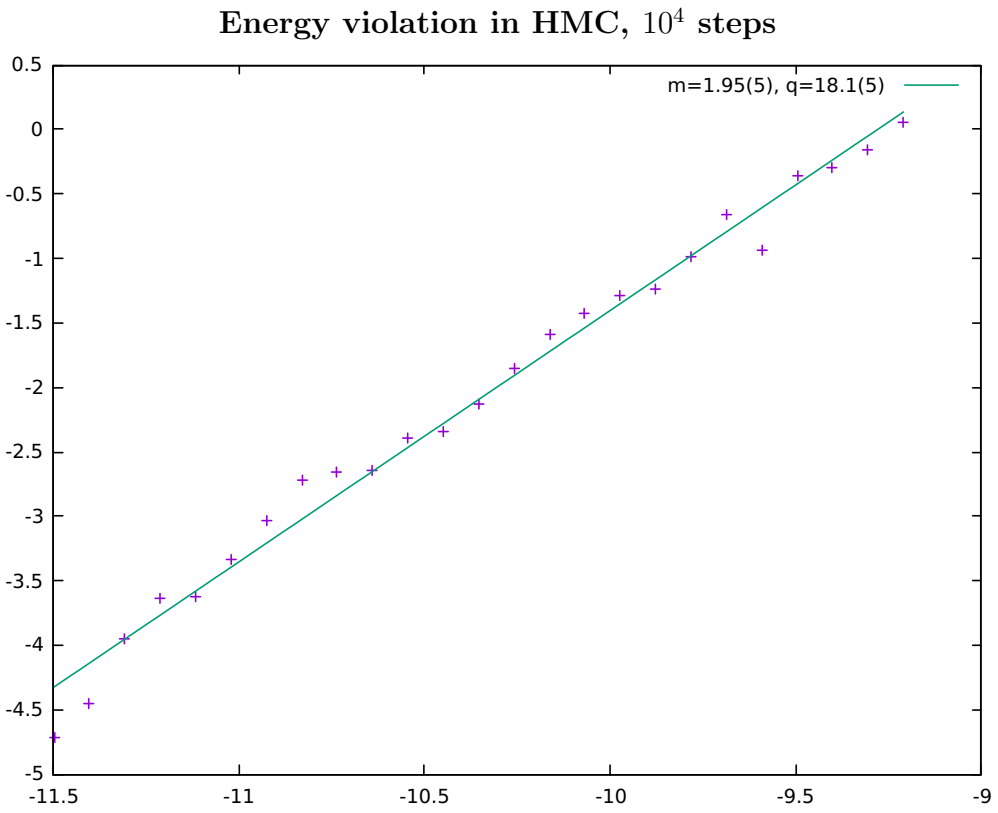

Figure 3: $\log \Delta H$ vs $\log \tau$ (purple): $(p, q) = (2, 0)$; $n = 10$; $g = -2.2431$; $L = 10^4$; Linear fit (green): $m = 1.95 \pm 0.05$, $q = 18.1 \pm 0.1$

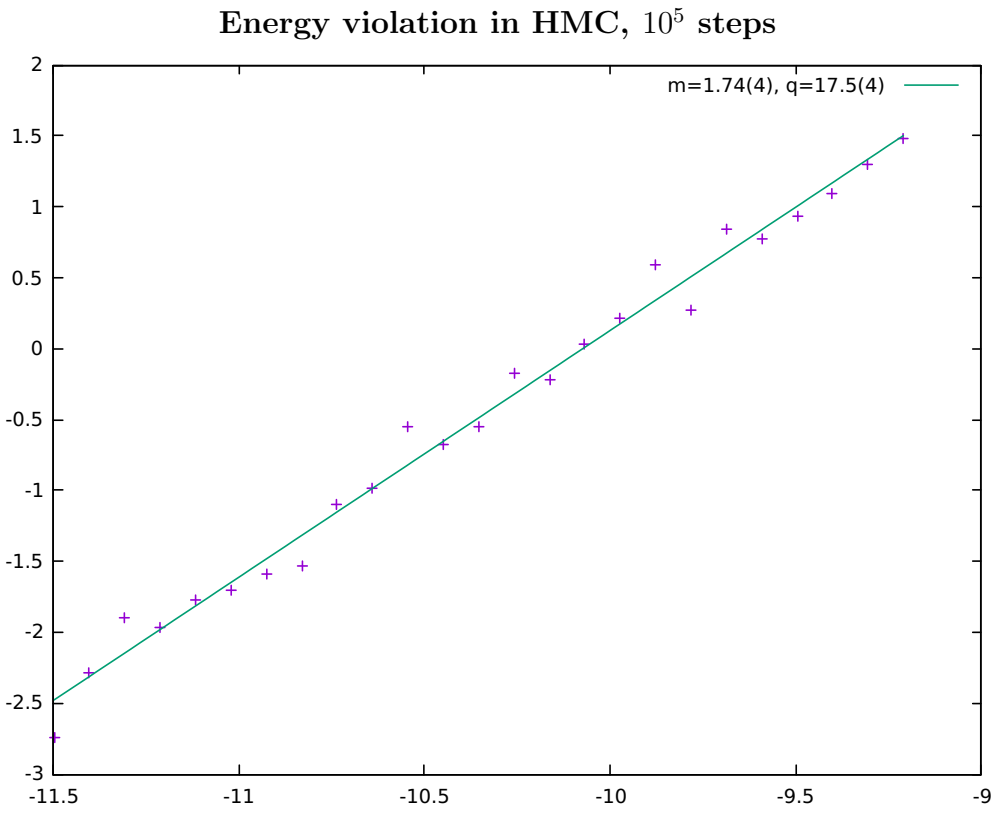

Figure 4: $\log \Delta H$ vs $\log \tau$ (purple): $(p, q) = (2, 0)$; $n = 10$; $g = -2.2431$; $L = 10^5$; Linear fit (green): $m = 1.74 \pm 0.04$, $q = 17.5 \pm 0.4$

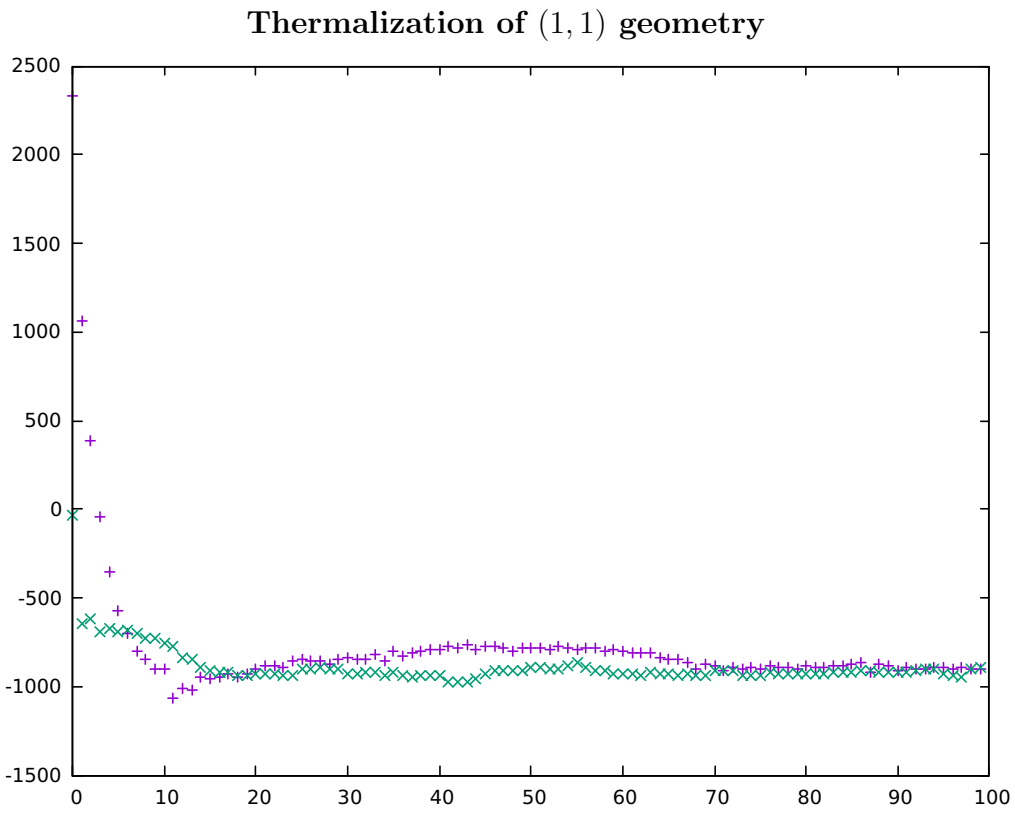

Figure 5: Action $\operatorname{Tr} D^4 + g \operatorname{Tr} D^2$ vs Monte Carlo time; $(p, q) = (1, 1)$; $n = 20$; $g = -2.5$; $L = 100$; $\tau_{\text{cold10}} = 0.0001$; $\tau_{\text{cold90}} = 0.0005$; $\tau_{\text{hot}} = 0.001$; time: 5s.

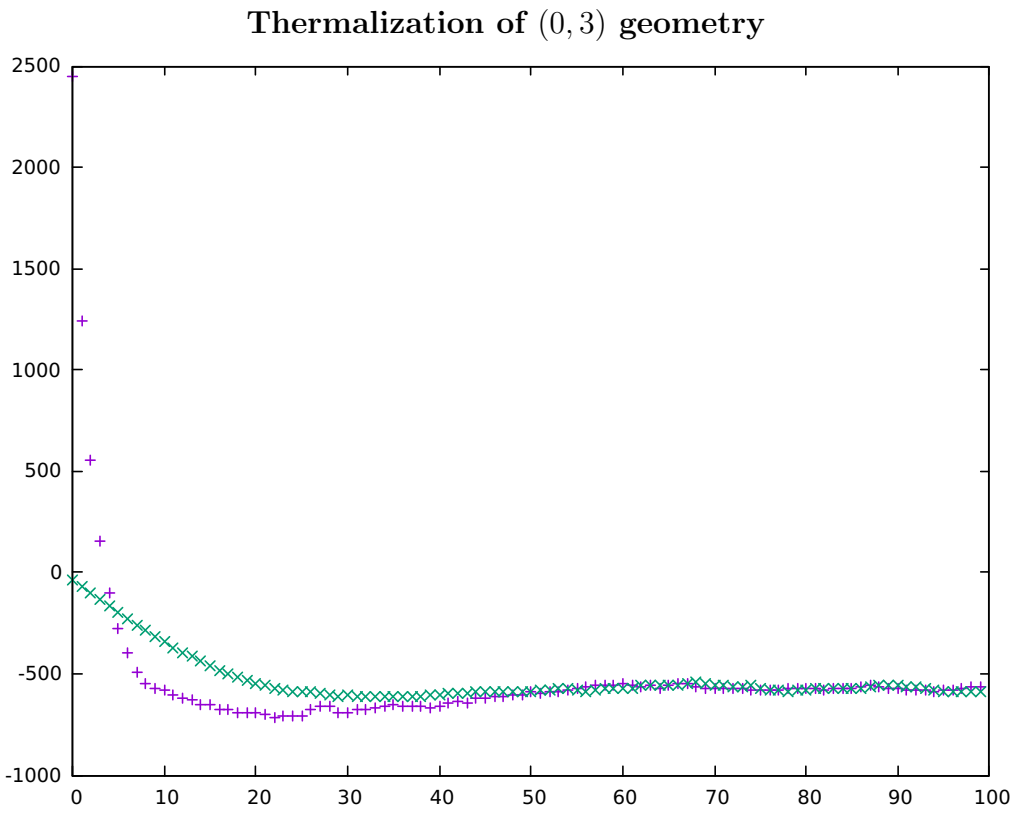

Figure 6: Action $\operatorname{Tr} D^4 + g \operatorname{Tr} D^2$ vs Monte Carlo time; $(p, q) = (0, 3)$; $n = 20$; $g = -2.5$; $L = 100$; $\tau = 0.0001$; time: 36s.

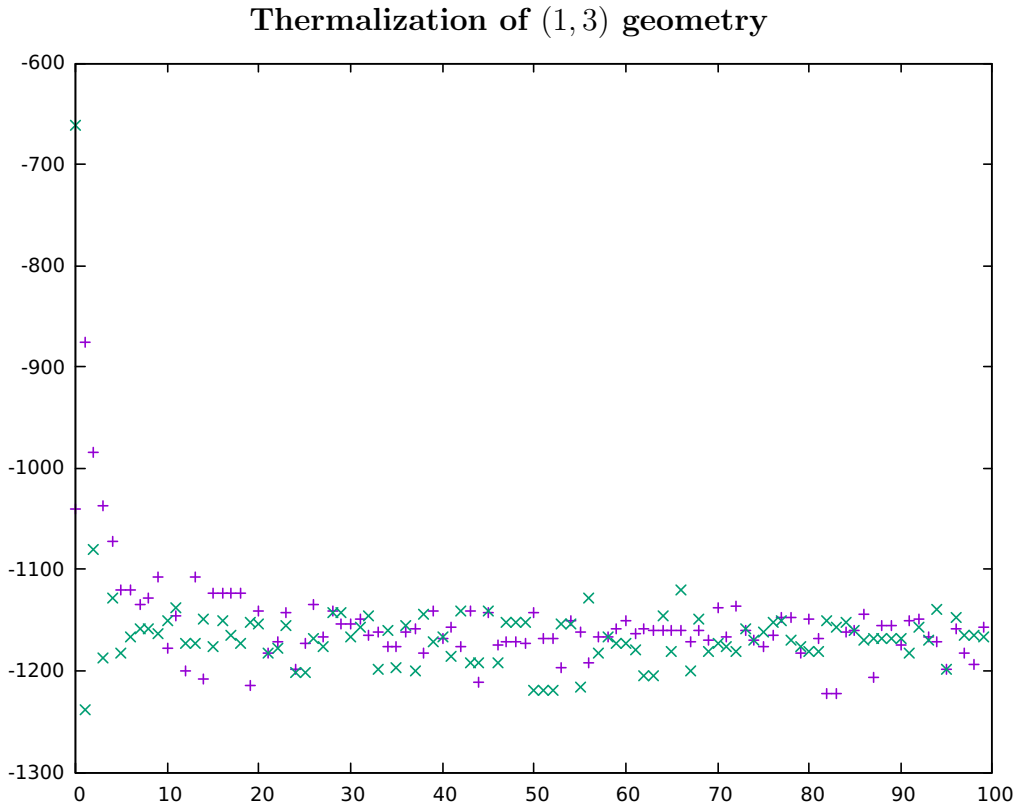

Figure 7: Action $\operatorname{Tr} D^4 + g \operatorname{Tr} D^2$ vs Monte Carlo time; $(p, q) = (1, 3)$; $n = 20$; $g = -2.5$; $L = 100$; $\tau_{\text{cold10}} = 0.001$; $\tau_{\text{cold90}} = 0.0005$; $\tau_{\text{hot}} = 0.0005$; time: 5m 40s.

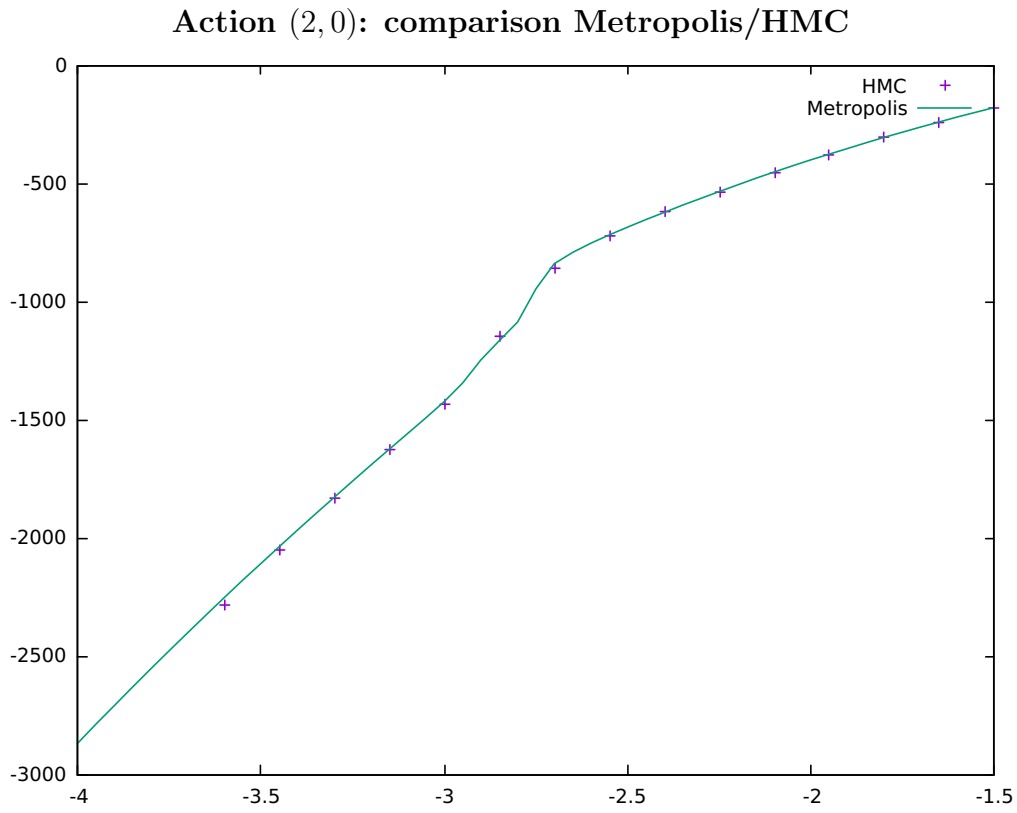

Figure 8: Action Tr $D^4 + g$ Tr D^2 vs g; Metropolis (Green) and HMC (purple); $(p, q) = (2, 0)$; $n = 20$; $L = 100$; $\tau = 0.0001$; time 13m 20s

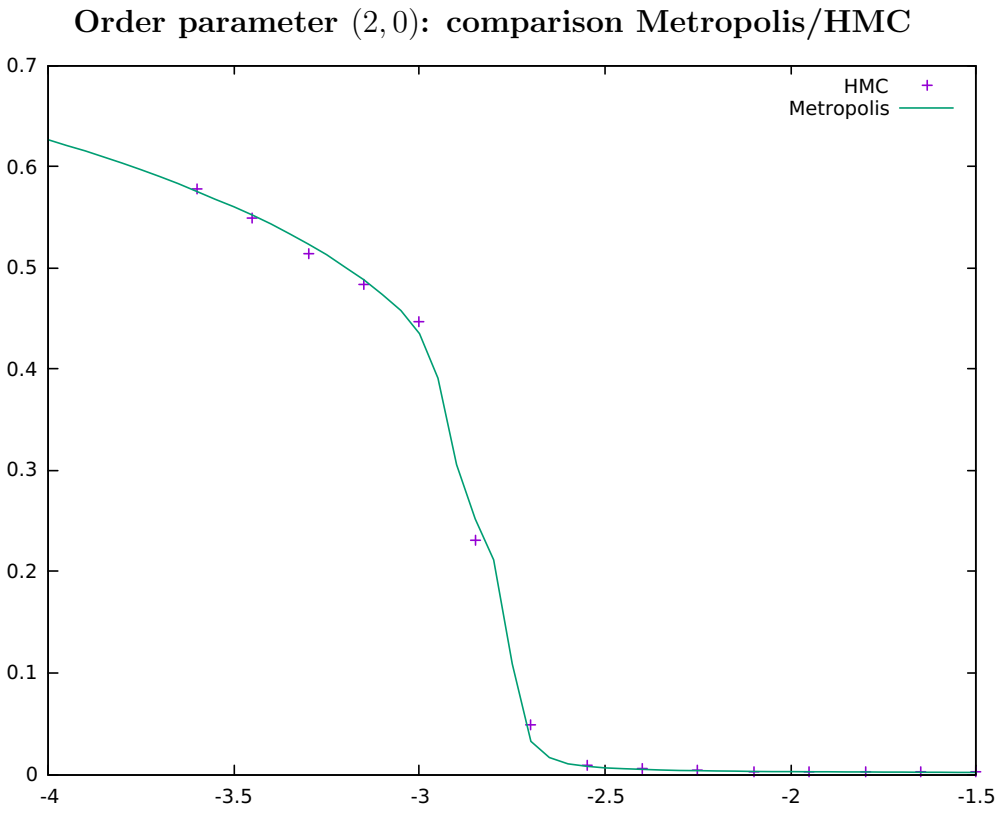

Figure 9: Order parameter vs g; Metropolis (Green) and HMC (purple); $(p,q) = (2,0)$; $n = 20$; $L = 100$; $\tau = 0.0001$; time 13m 20s