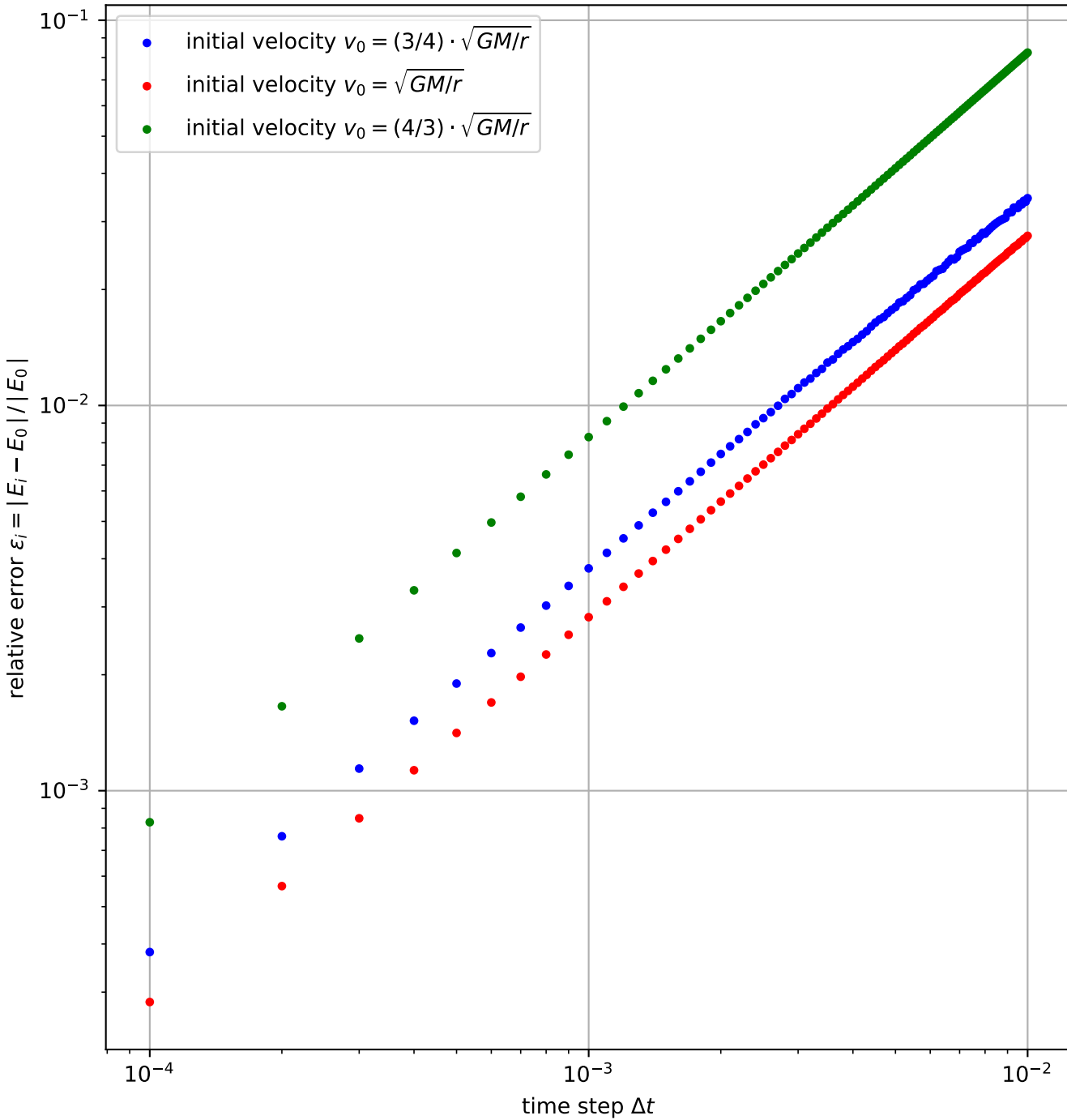Numerical Simulation of the Two-Body Problem: Error Analysis of the Integration Schemes
relative error $\varepsilon_i = |E_i - E_0| / |E_0|$ in the energy at the end of the second orbit as a function of the time step Δt

Error Analysis of the Euler Method

- initial velocity $v_0 = (3/4) \cdot \sqrt{GM/r}$
- initial velocity $v_0 = \sqrt{GM/r}$
- initial velocity $v_0 = (4/3) \cdot \sqrt{GM/r}$

Error Analysis of the Leapfrog Method

- initial velocity $v_0 = (3/4) \cdot \sqrt{GM/r}$
- initial velocity $v_0 = \sqrt{GM/r}$
- initial velocity $v_0 = (4/3) \cdot \sqrt{GM/r}$

relative error $\varepsilon_i = |E_i - E_0| / |E_0|$

time step Δt