PHYS 503 **Problem set # 1** **Due: Jan. 26, 2022, 2pm**

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1. (5 points) Show that the Green's function $G_{ij}(t,t') = -i\langle T[u_i(t)u_j(t')]\rangle$ depends only on $t - t'$ whenever the system Hamiltonian H is time independent.

2. (10 points) Derive Eq. (1.5.12) from the textbook following the steps that lead to Eq. (1.5.11).

3. (20 points) Consider a one-dimensional chain of atoms with mass M connected each to its two neighbors by an elastic spring with spring constant K. The atoms are allowed to vibrate in the direction along the chain only. Find the time-ordered, advanced and retarded $T = 0$ Green's functions $G_k(\omega)$, $G_k^A(\omega)$ and $G_k^R(\omega)$ for the displacements of the atoms u_j.