On certain electromagnetic field-induced interatomic interactions
J.F. BABB, ITAMP, Harvard-Smithsonian — The long-range retarded dispersion interaction potential between two neutral isotropic polarizable systems is attractive with the characteristic Casimir-Polder form $\sim -\frac{1}{23} \alpha_1 \alpha_2 / R^7$, where $\alpha_i$ is the static electric dipole polarizability of a particle and $R$ is the intersystem separation. In contrast, the long-range retarded interaction between an electron and an ion is repulsive with form $\frac{11}{R^5}$, where $\alpha$ is the ion’s polarizability. Theoretically, a way to form a stable BEC with attractive $1/R$ interactions was proposed [1]. Using external laser beams the average interatomic potential is $\sim -11(I q^2 / c) \alpha(q)^2 / R$, where $I$ is the laser intensity, $\alpha(q)$ the atomic polarizability, and $cq$ is the frequency. The connections between this (under certain conditions) “artificial gravity-like interaction” and more standard long-range dispersion forces are explored. In addition, similarities to “optical binding” are discussed. Supported in part by the NSF.