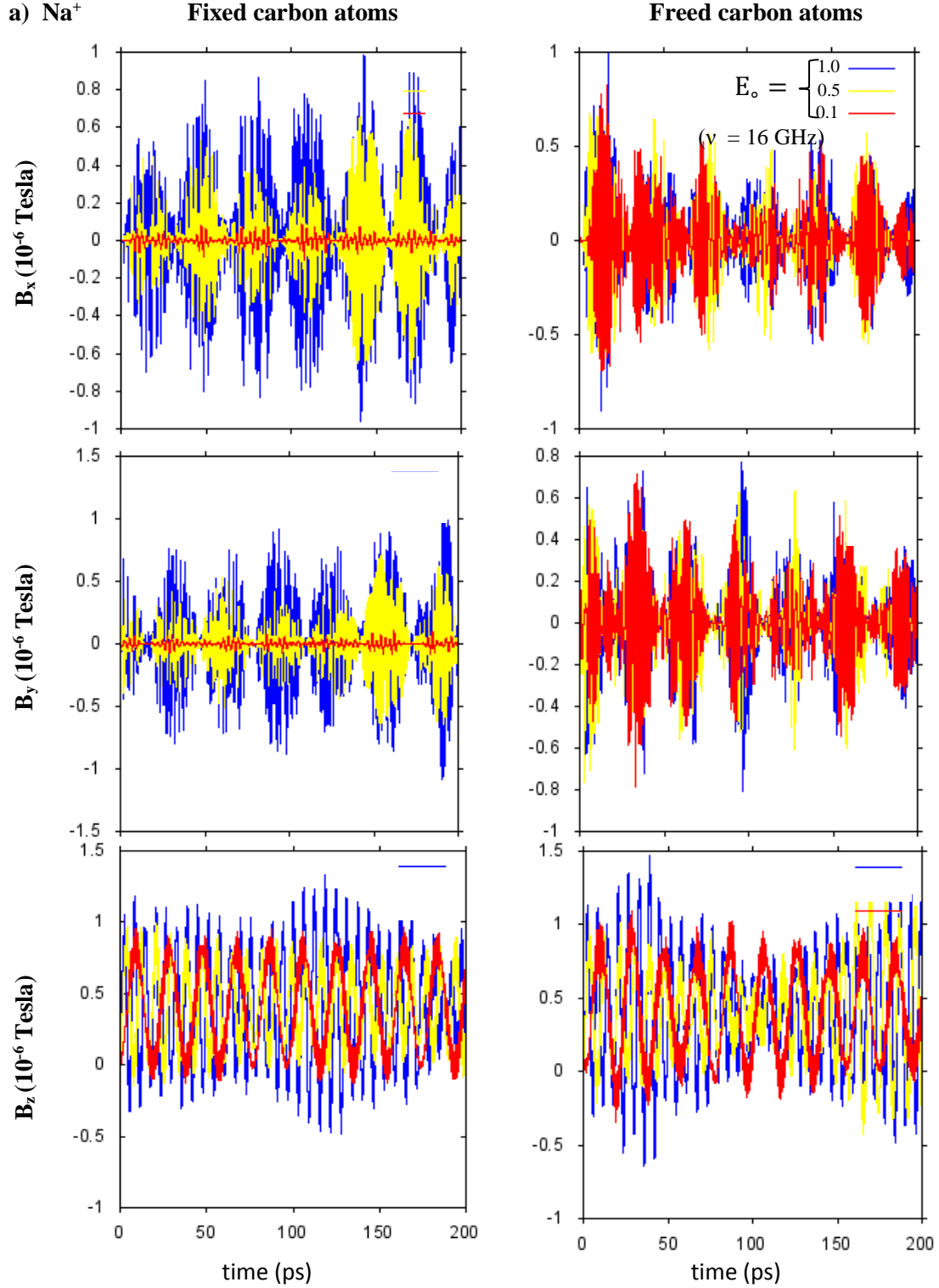# Nano-sized local magnetic field induced by circular motion of ions and molecules in a nanotorus under gigahertz rotating electric fields

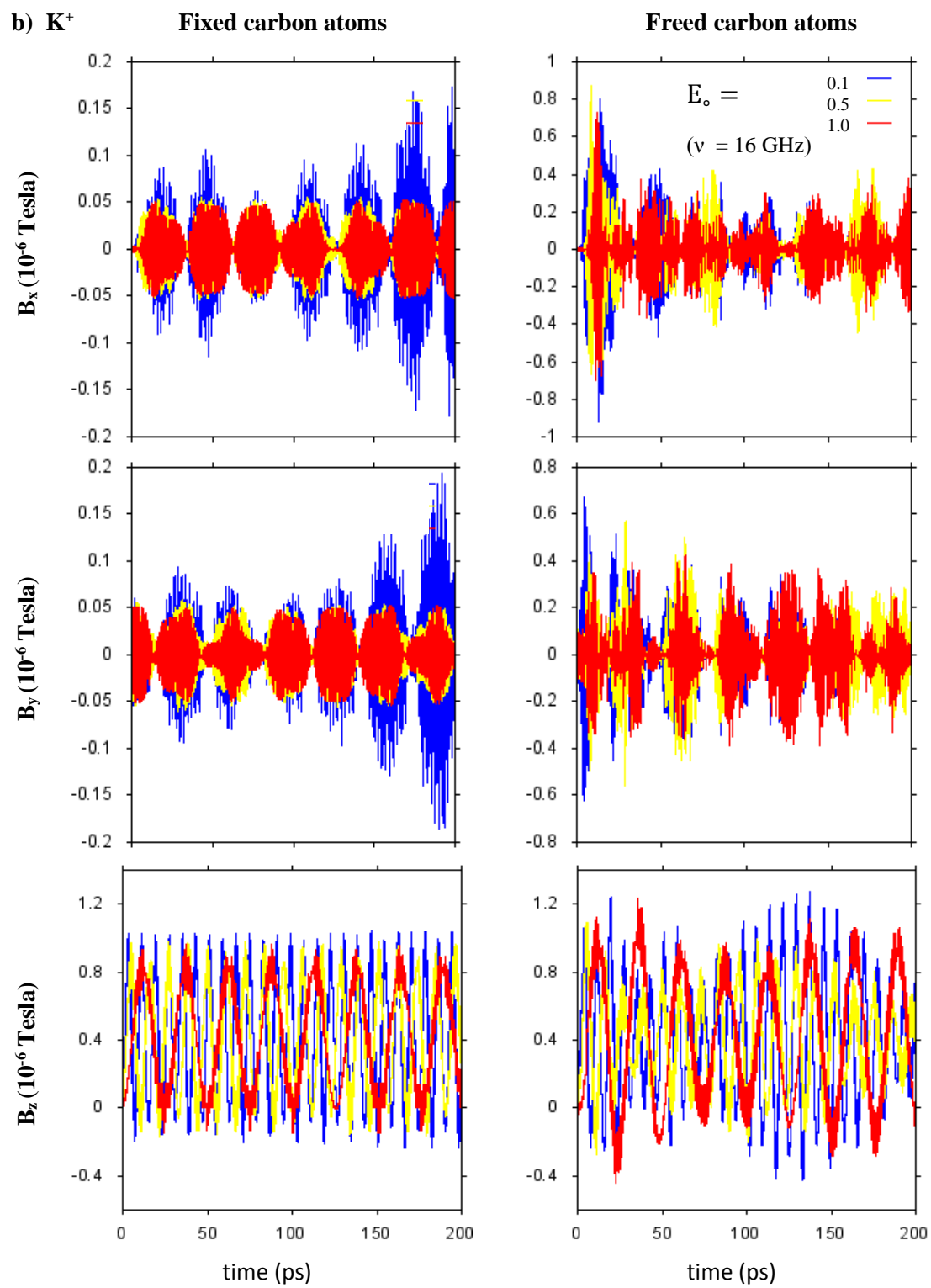Maryam Kowsar[1] and Hassan Sabzyan[2]*

[1] Department of Chemistry, Shahid Beheshti University, Tehran 19839-63113, I. R. Iran.

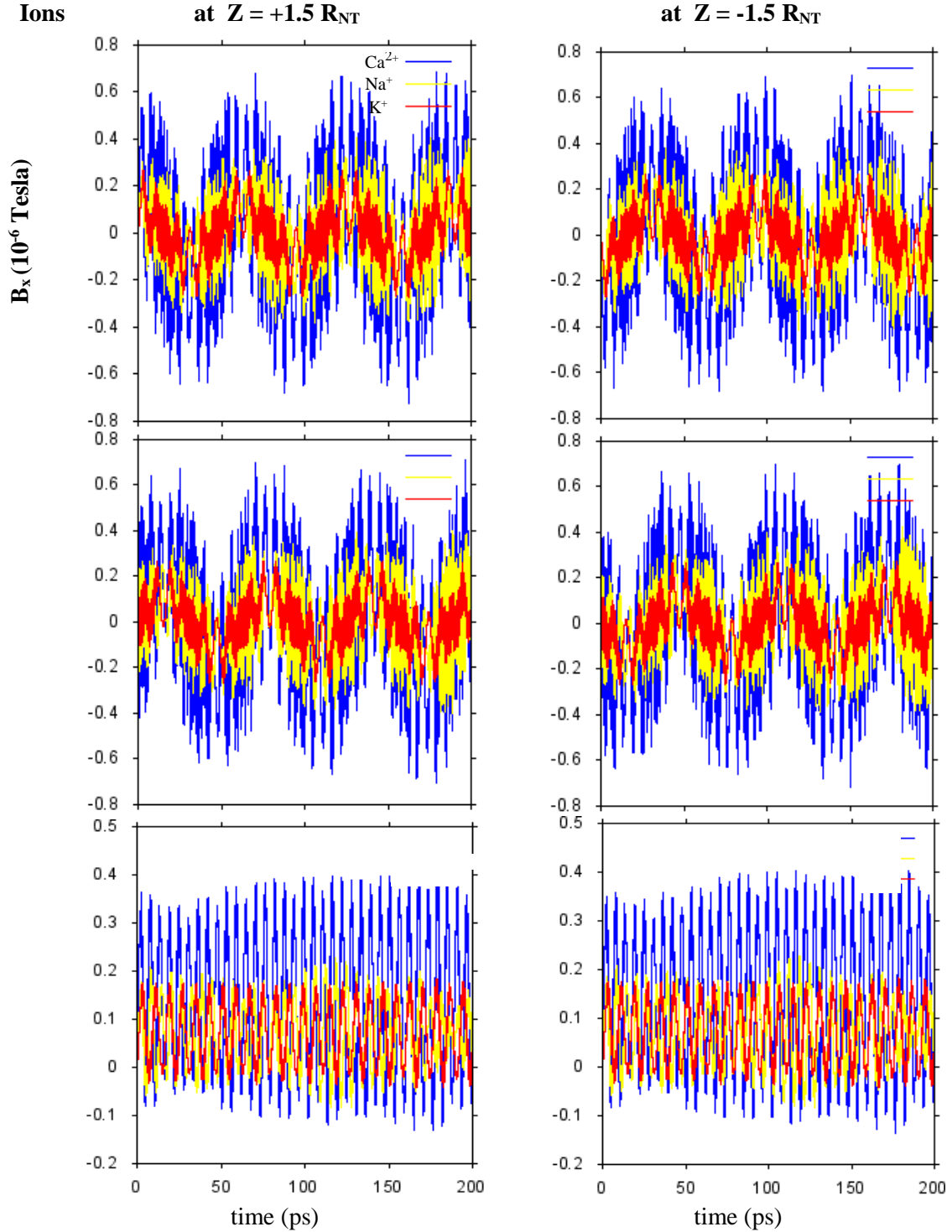[2] Department of Chemistry, University of Isfahan, Isfahan, 81746-73441, I. R. Iran.

Supplementary Materials

Figure S-1. Variations of the magnetic field components B_x, B_y and B_z induced at the center by the cyclotron motion of the (a) Na^+ and (b) K^+ ions in the (6,6) carbon nanotorus of circle radius of $R_{NT} = 3.914$ nm and tube radius of $r_{CNT} = 0.406$ nm in the presence of a rotating EF ($E_{\circ} = 1.0$ V/nm, $\nu = 16$ GHz). Note the different scales used for different plots.
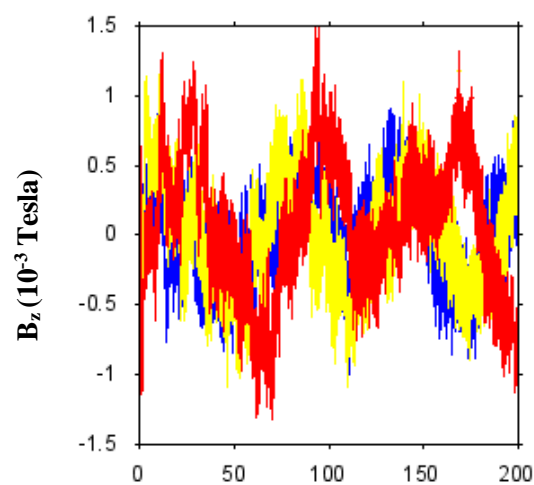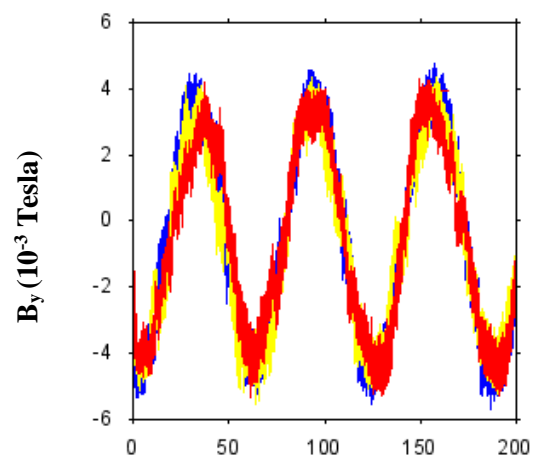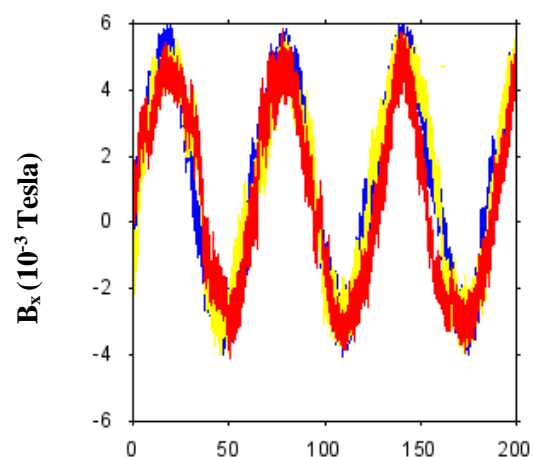
b) K⁺ **Fixed carbon atoms** **Freed carbon atoms**

Figure S-1. … Continued

Ions   **at Z = +1.5 R$_{NT}$**   **at Z = -1.5 R$_{NT}$**

time (ps)   time (ps)
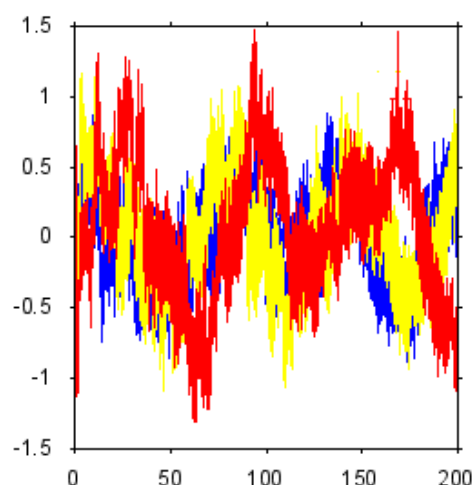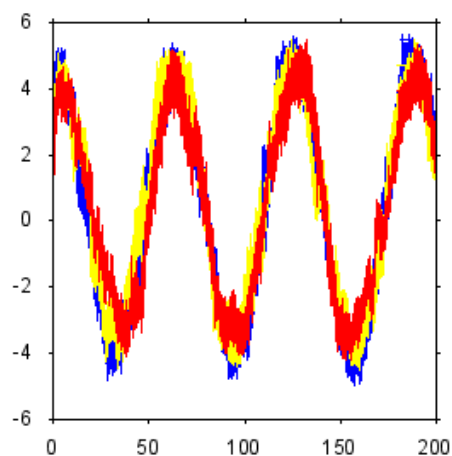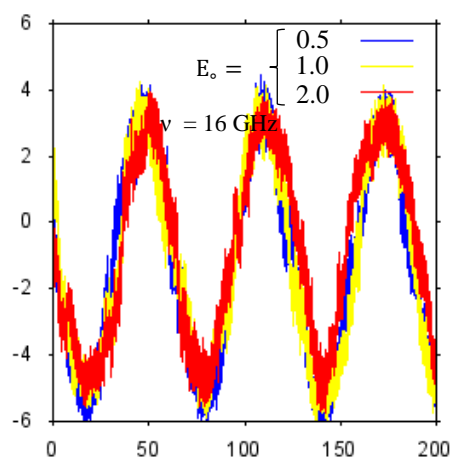
Figure S-2. Variations of the components of the MF (B$_x$, B$_y$ and B$_z$) induced by the cyclotron motion of the ions (Ca^{2+}, Na$^+$ and K$^+$ depicted respectively in blue, yellow and red) in the (6,6) carbon nanotorus of radius of R$_{NT}$ = 39.144 Å in the presence of the rotating EF of E$_o$ = 1.0 V/nm strengths ν = 16 GHz frequency, at the two corresponding points (0,0,-1.5R$_{NT}$) and (0,0,+1.5R$_{NT}$) on the z-axis. These results are obtained for the simulations with fixed carbon atoms.

Figure S-3. The same as Fig. S-2, but for the MF induced by cyclotron motion of 81 water molecules induced by the rotating EF of $E_o = 0.5, 1.0$ and 2.0 V/nm, at $z = 2\,R_{NT}$ (left column) and $z = -2\,R_{NT}$ (right column) points on the z-axis.