Electronic Supplementary Material (ESI) for RSC Advances.

†Electronic Supplementary Information (ESI)

Eu^{3+} doped α-sodium gadolinium fluoride luminomagnetic nanophosphor as a bimodal nanoprobe for high-contrast *in vitro* bioimaging and external magnetic field tracking applications

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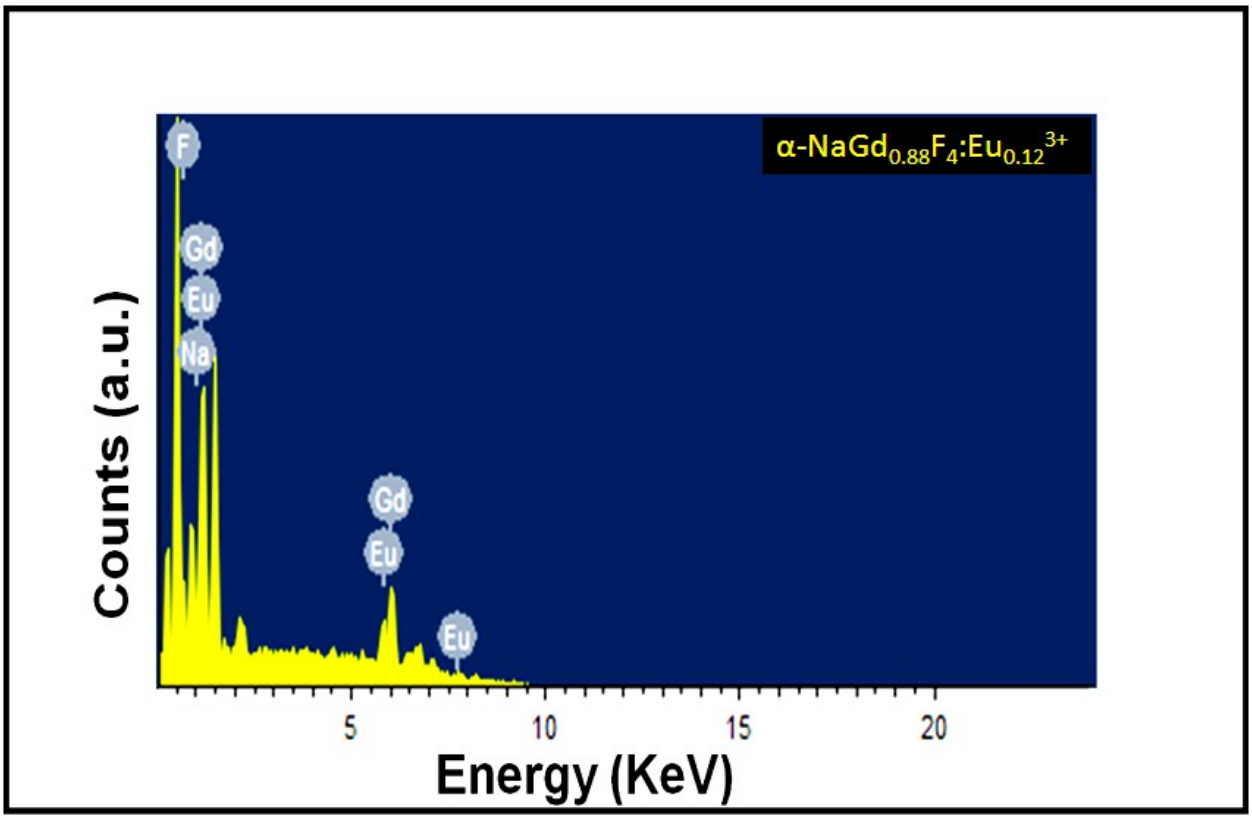

Fig. S1 The EDAX spectrum of α-$NaGd_{0.88}F_4:Eu_{0.12}^{3+}$ nanophosphor, which indicates the presence of the Na, Gd, Eu and F elements in nanophosphor.

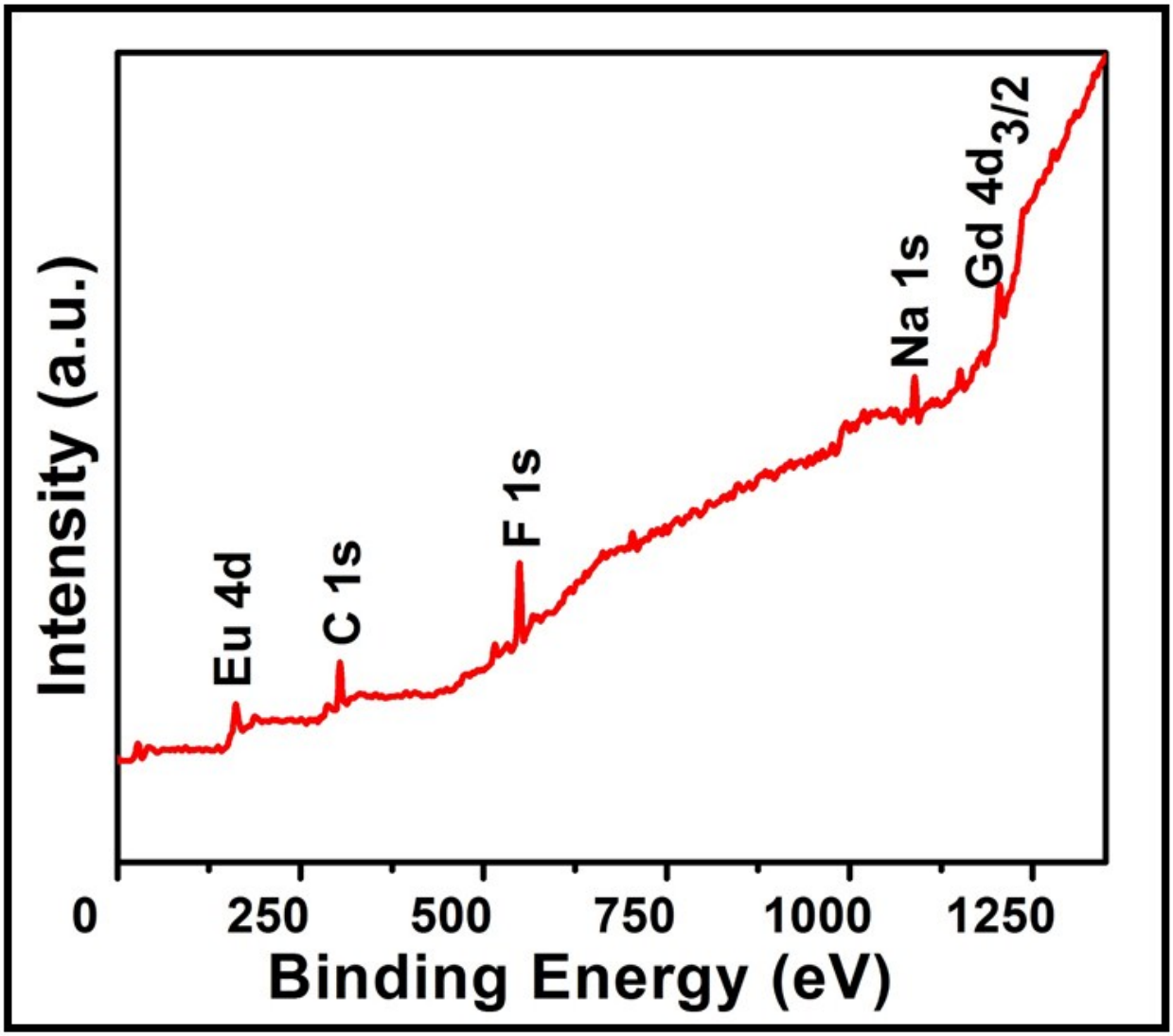

Fig. S2 XPS survey scan spectrum of α-$NaGd_{0.88}F_4:Eu_{0.12}^{3+}$ nanophosphor.

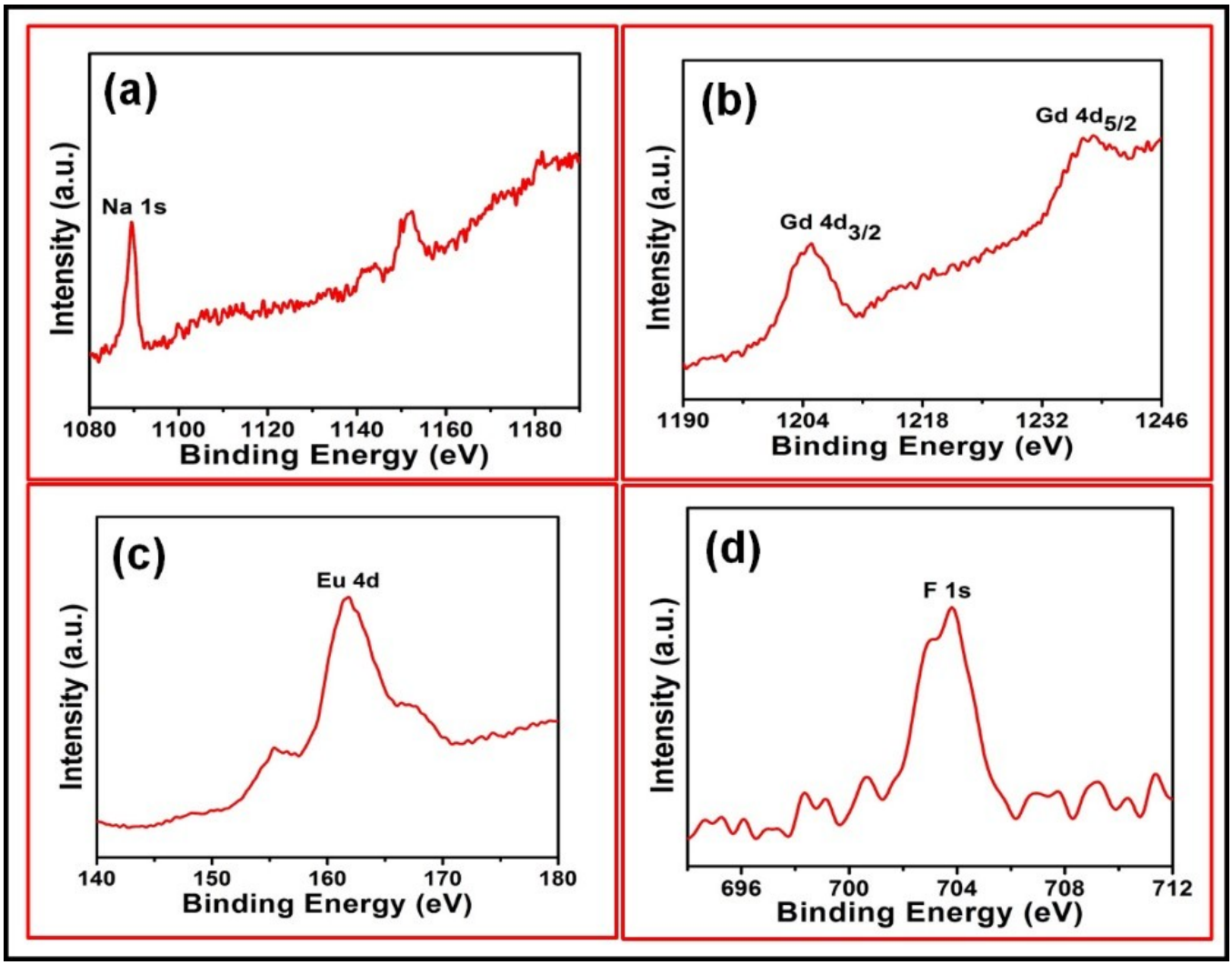

Fig. S3 Core level spectra of α-$NaGd_{0.88}F_4:Eu_{0.12}^{3+}$ nanophosphor (a) Na, (b) Gd, (c) Eu and (d) F.

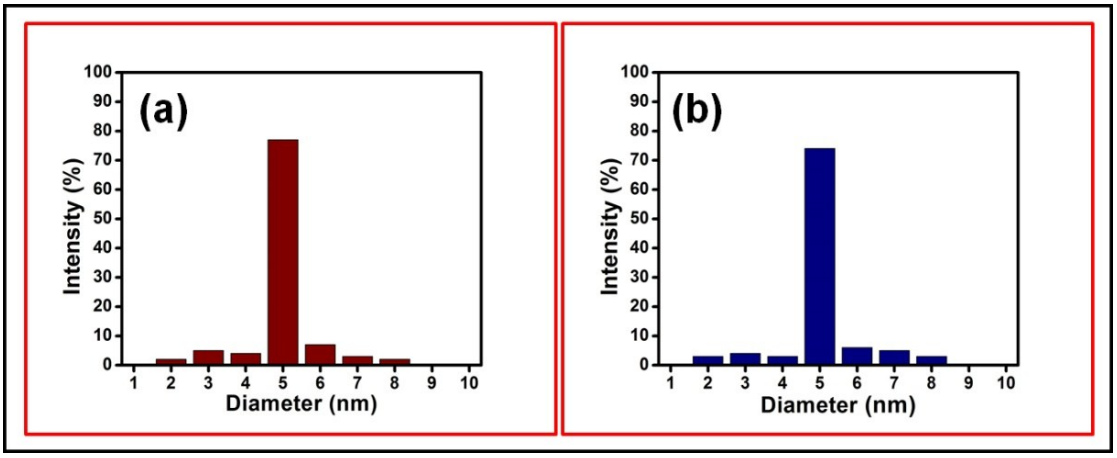

Fig. S4 Size distribution plots obtained from DLS studies for α-$NaGd_{0.88}F_4:Eu_{0.12}^{3+}$ nanophosphor dispersed in (a) ethanol and (b) DI water.

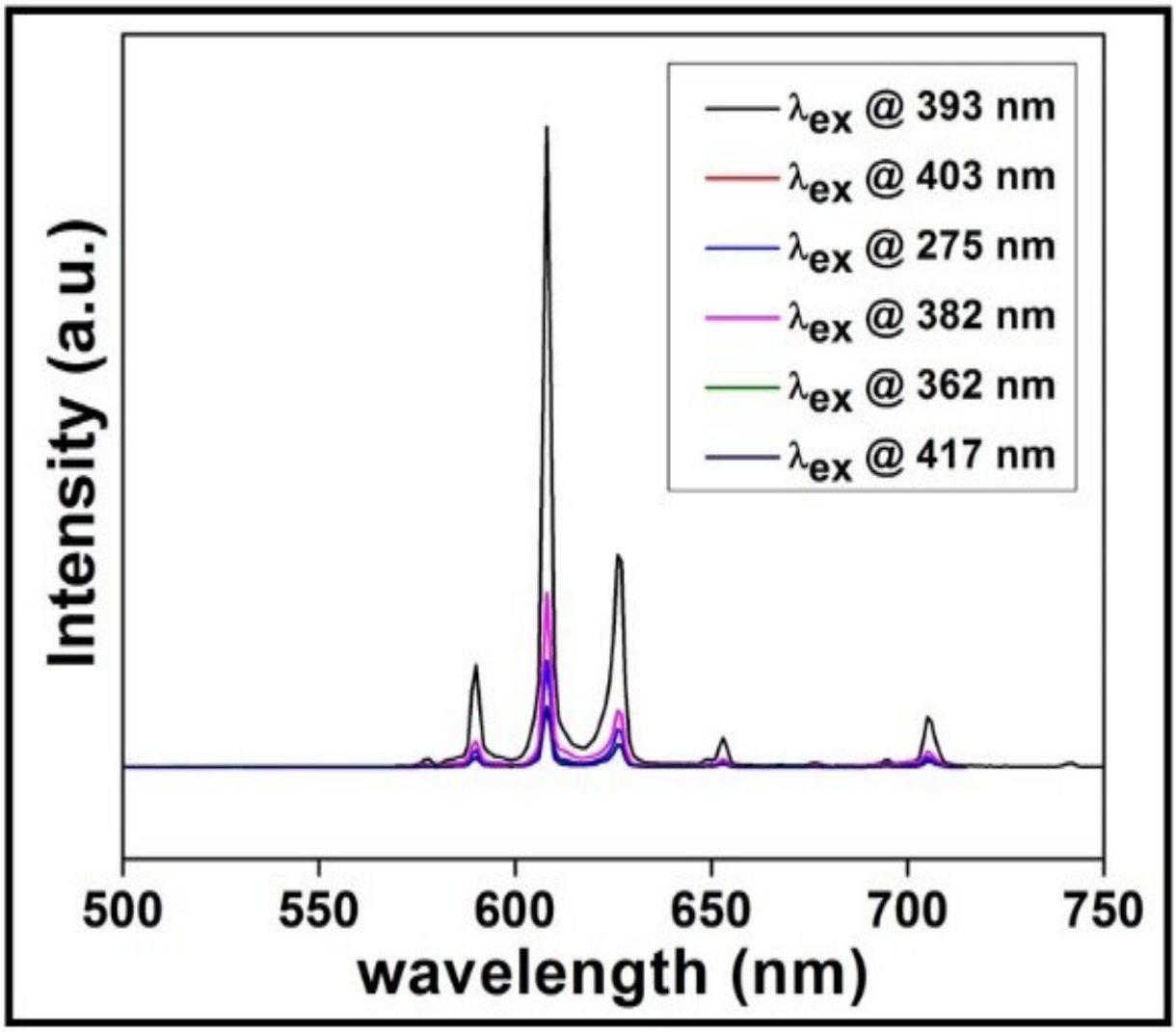

Fig. S5 PL emission spectra of α-$NaGd_{0.88}F_4:Eu_{0.12}^{3+}$ nanophosphor under different excitation wavelengths.

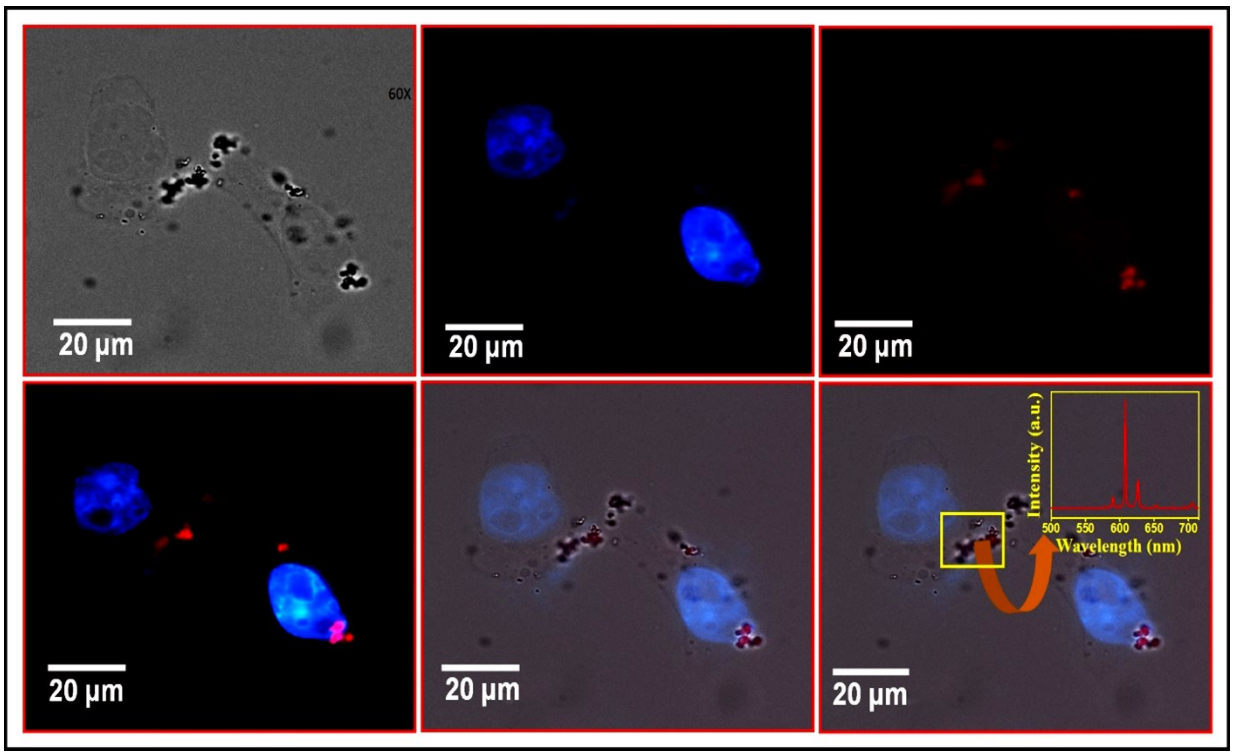

Fig. S6 *In vitro* fluorescent microscopic images of HeLa cells, incubated with α-$NaGd_{0.88}F_4:Eu_{0.12}^{3+}$ nanophosphor. Sequential images show; (a) phase contrast picture of HeLa cells, (b) individual nucleus stained blue with DAPI, (c) red fluorescence staining by α-$NaGd_{0.88}F_4:Eu_{0.12}^{3+}$ nanophosphor, (d) overlapped image from blue DAPI and red α-$NaGd_{0.88}F_4:Eu_{0.12}^{3+}$ nanophosphor images , (e) overlap of phase contrast, blue and red from (a), (b) and (c) images respectively, (f) *in vitro* localized PL image of α-$NaGd_{0.88}F_4:Eu_{0.12}^{3+}$ nanophosphor from (e). Inset of (f) shows the localized PL taken from α-$NaGd_{0.88}F_4:Eu_{0.12}^{3+}$ nanophosphor labelled HeLa cells (red).

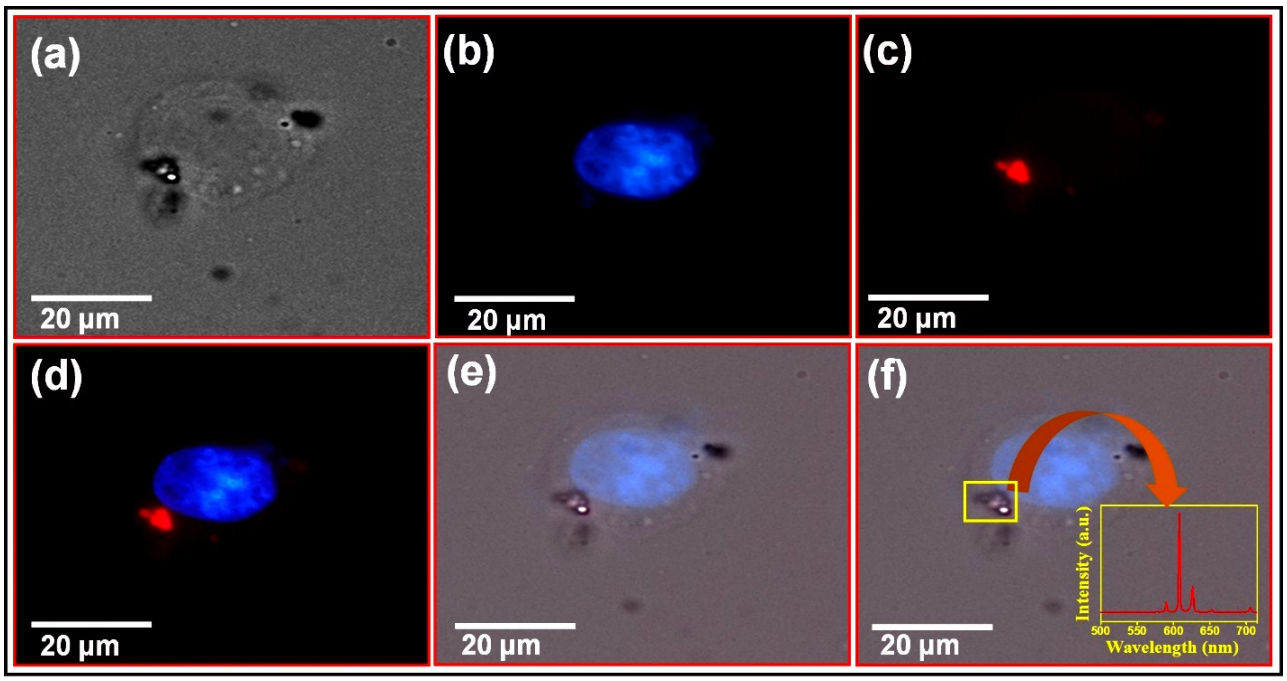

Fig. S7 *In vitro* fluorescent microscopic images of HeLa cells, incubated with α-$NaGd_{0.88}F_4:Eu_{0.12}^{3+}$ nanophosphor. Sequential images show; (a) phase contrast picture of HeLa cells, (b) individual nucleus stained blue with DAPI, (c) red fluorescence staining by α-$NaGd_{0.88}F_4:Eu_{0.12}^{3+}$ nanophosphor, (d) overlapped image from blue DAPI and red α-$NaGd_{0.88}F_4:Eu_{0.12}^{3+}$ nanophosphor images , (e) overlap of phase contrast, blue and red from (a), (b) and (c) images respectively, (f) *in vitro* localized PL image of α-$NaGd_{0.88}F_4:Eu_{0.12}^{3+}$ nanophosphor from (e). Inset of (f) shows the localized PL taken from α-$NaGd_{0.88}F_4:Eu_{0.12}^{3+}$ nanophosphor labelled HeLa cells (red).