Supplementary information

SI.1.

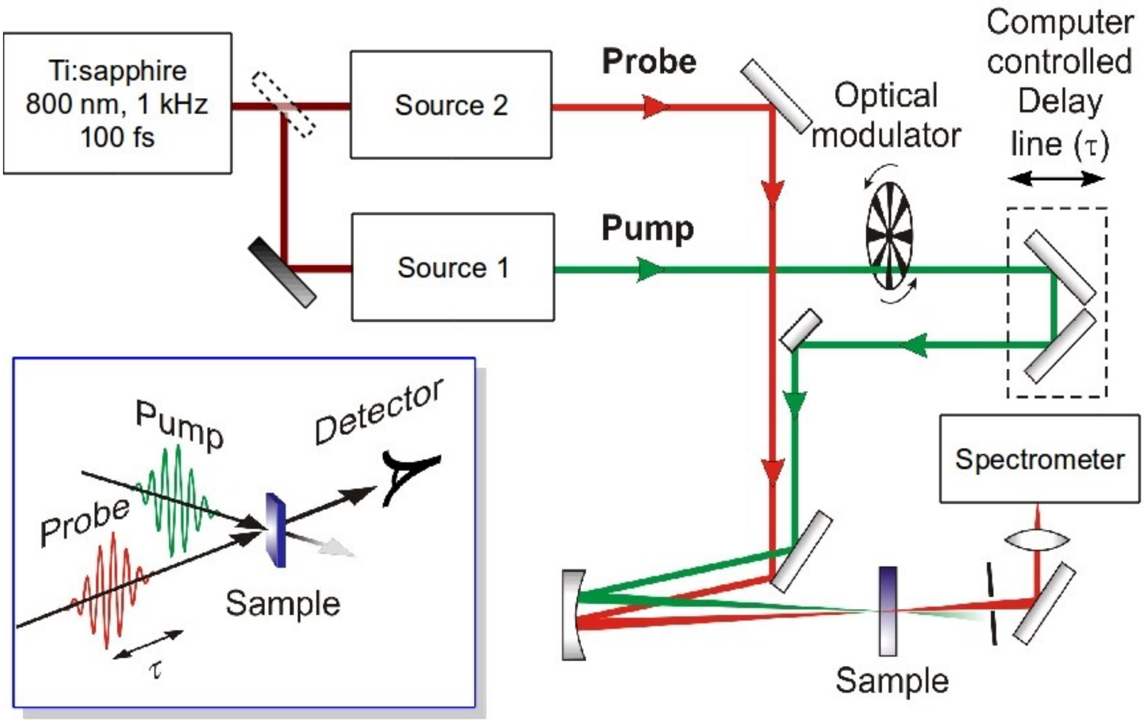

Figure SI 1: Experimental set-up of the femto-second pump laser unit and detection system used in this study.

SI.2. The best χ^2 fit can be achieved by 1-exp y0+A exp(-invTau*t) function for A window of 0-2ps.: Trace of 405 nm y0 = -0.00071 ± 0.00013, A= -0.0020 ± 9.07e-05, invTau = 1.04 ± 0.18 1/ps Trace of 518 nm y0= 0.0018 ± 1.07e-05, A = 0.0022 ± 4.4e-05, invTau = 2.7 ± 0.09 1/ps Trace of 688 nm y0 = 0.0017 ± 1.74e-05, A = 0.0022 ± 3.6 e-05, invTau = 2 ± 0.07 1/ps.

For time window B) 0-15 ps the best χ^2 fit is 2-exp function y0+A1 exp(-invTau1*t)+ A2 exp(-invTau2*t) with time constants as :

Trace of 405 nm y0 = -0.00068 ± 3.9e-05, A1= -0.0016 ± 0.00034, invTau1 = 0.80 ± 0.15 1/ps, A2 = - 0.00071 ± 0.0003, invTau2 = 3.9 ± 0.4 1/ps;

Trace of 518 nm y0 = 0.001 ± 3.76e-05, A1= 0.001 ± 2.6e-05, invTau1 = 0.2 ± 0.024 1/ps, A2 = 0.0023 ± 0.00026, invTau2 = 3.7 ± 0.35 1/ps;

Trace of 688 nm y0= 0.0011 ± 2.3e-05, A1 = 0.0013 ± 3.5e-05, invTau1 = 0.29 ± 0.025 1/ps, A2= 0.0025 ± 9.5e-05, invTau2 = 3.89 ± 0.23 1/ps

For time window C) 0-500ps the best χ^2 fit is 2-exp function y0+A1 exp(-invTau1*t)+ A2 exp(-invTau2*t) with time constants:

Trace of 405 nm y0 = -0.00036 ± 2.8e-05, A1 = -0.00039 ± 3.5e-05, invTau1 = 0.011 ± 0.0034 1/ps, A2 = -0.0019 ± 0.0001, invTau2 = 1.0 ± 0.09 1/ps

Trace of 518 nm y0 = 0.00054 ± 7.2e-06, A1 = 0.00093 ± 2.5e-05, invTau1 = 0.027 ± 0.0016 1/ps, A2 = 0.0013 ± 2.9e-05, invTau2 = 0.74 ± 0.036 1/ps

Trace of 688 nm y0 = 0.00046 ± 6.3e-06, A1 = 0.0014 ± 1.5e-05, invTau1 = 0.06 ± 0.0015 1/ps, A2 = 0.0023 ± 4.85e-05, invTau2 = 2.26 ± 0.074 1/ps

SI.3.

Kolrausch stretched exponential approximation of the transient decay. The stretched exponential function $\Delta A(t)=\Delta A_0*\mathrm{exp}(-(t/\tau)^{\beta})$ can be applied to approximate the transient decay in iron oxide within a 3 decadic time range. The stretched exponential function describes not only electronic but also molecular relaxation in different materials. Figure 1, shows that the stretched exponential fits the decay data.

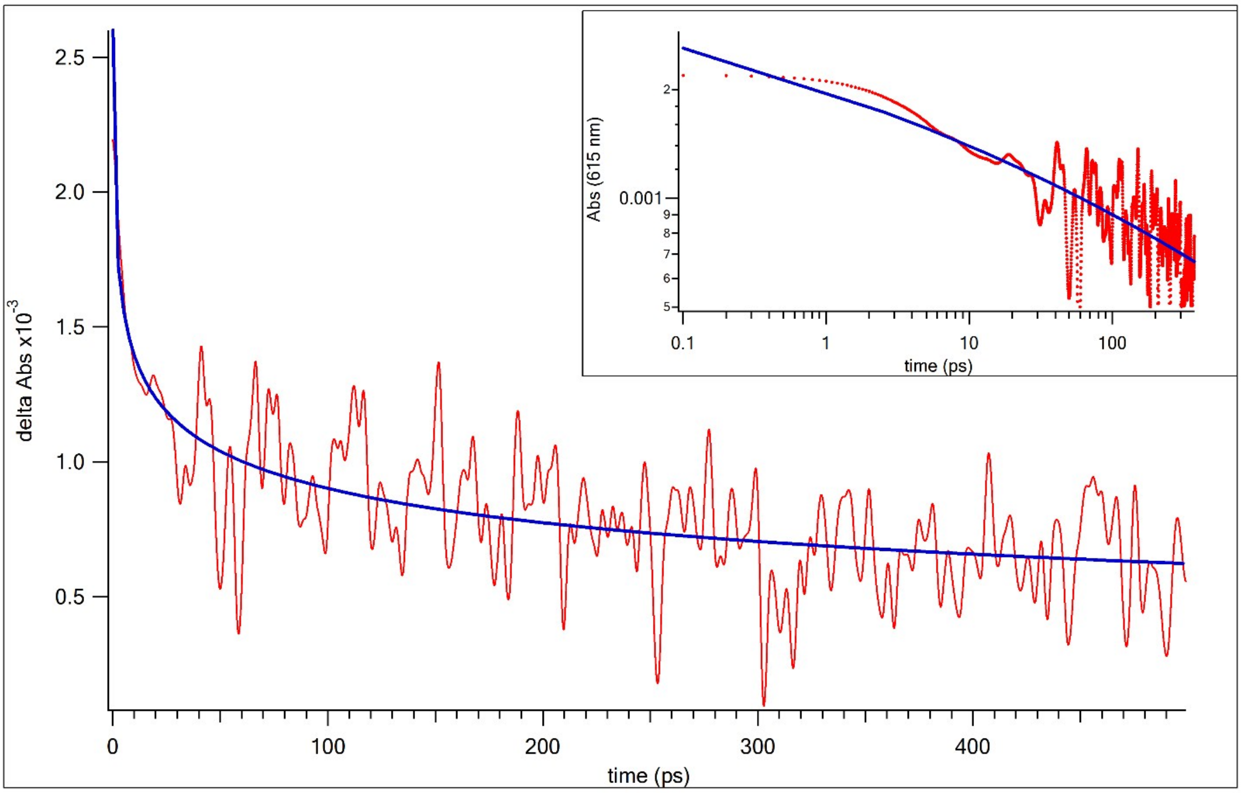

Figure SI 2. Transients for FeOx-TiO$_2$ film was approximated by the stretched exponential function $\Delta A(t)=\Delta A_0*\mathrm{exp}(-(t/\tau)^{\beta})$ where

τ = 0.005 ± 0.0006 ps

β = 0.088 ± 0.001

SI.4.

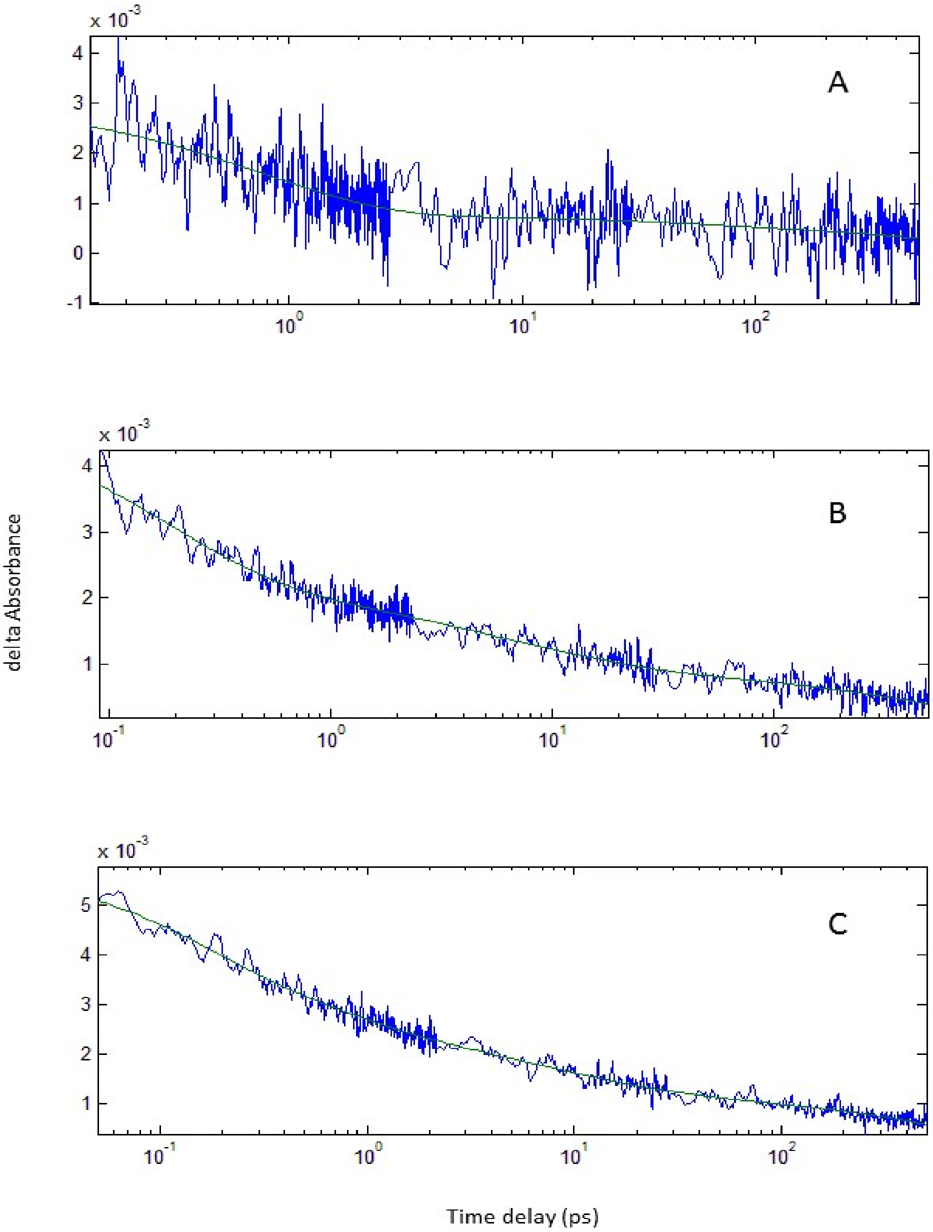

Figure SI 3. The results of the fit by a regularized inverse Laplace Transform for different probe wavelengths is shown in the continuous line: A) 405 nm; B) 518 nm; C) 688 nm. Delta Absorbance at 405 nm show negative Absorbance values.