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Supporting Information

Clusters from Clusters: Bright, NIR Emitting Au_{23} from Au_{25}- Charecterisation and Applications Including Bio-Labeling

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Supporting information 1

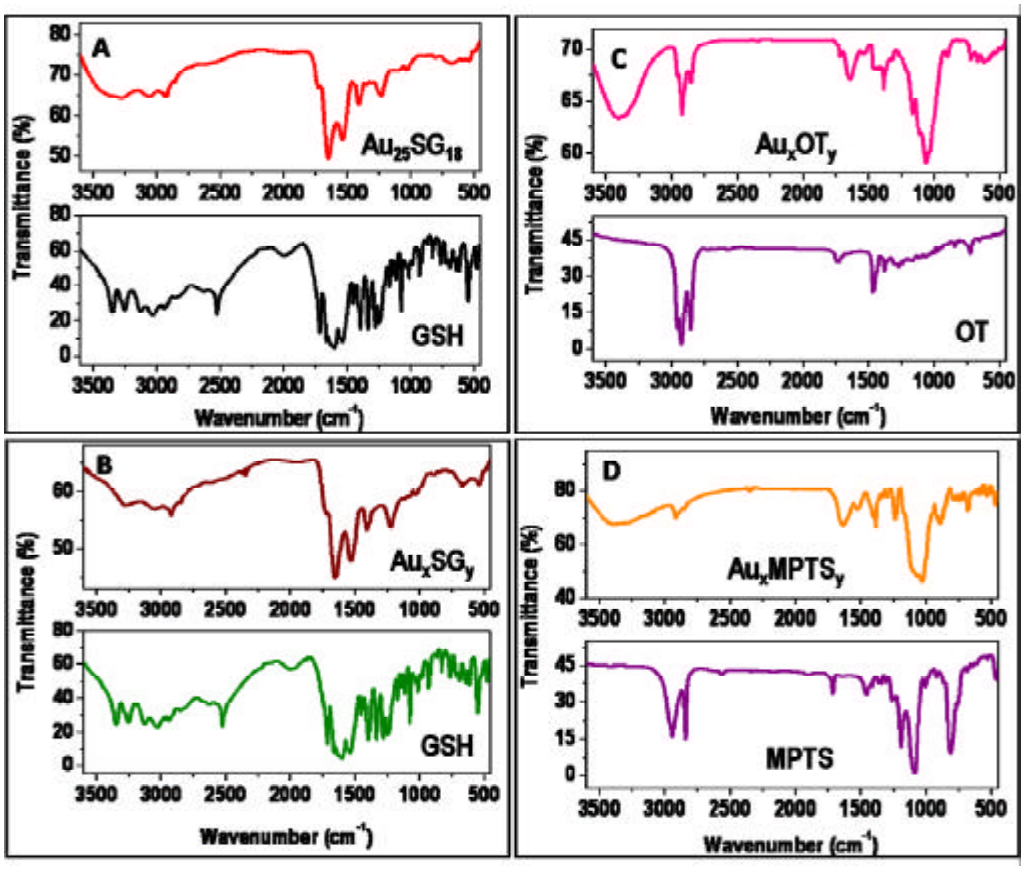
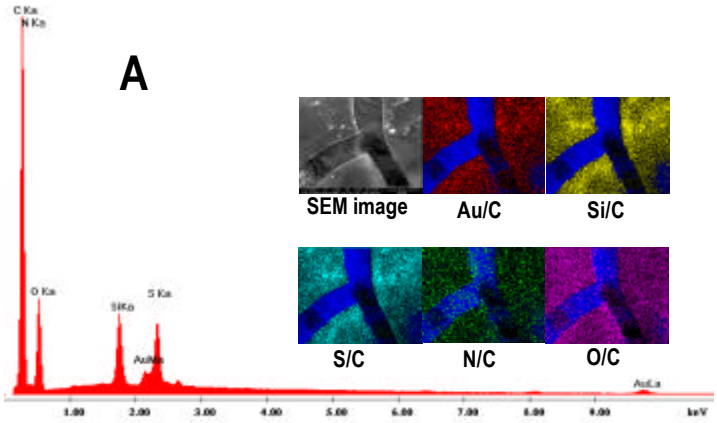
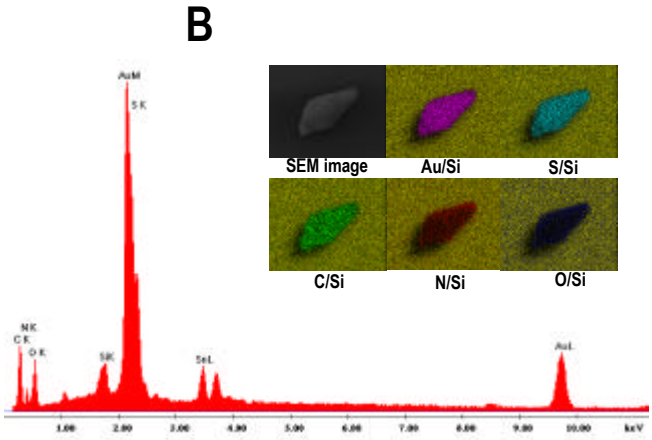
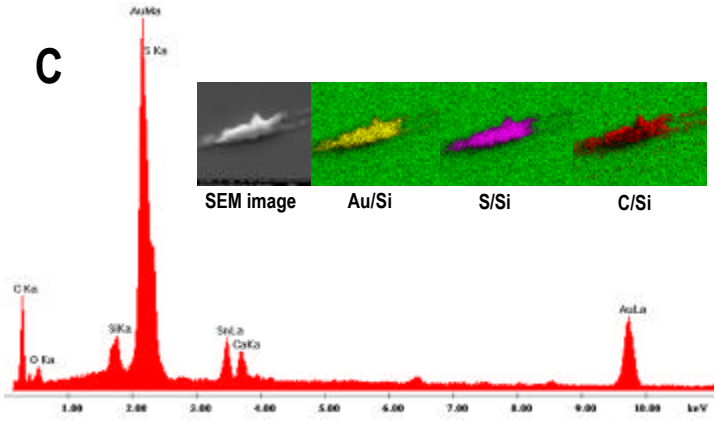


Figure S1. Comparison of the FT-IR spectra of the clusters and the corresponding ligands used for etching, with the parent $Au_{25}SG_{18}$.

Supporting information 2







Sample	Element	% of element (Experimental)	% of element (Calculated)	Molecular formula
Au_xMPTS_y	N	03.85	03.68	$Au_{22}(MPTS)_{10}(SG)_7$
	C	15.29	15.03	
	H	02.71	02.62	
	S	06.31	06.81	
Au_xSG_x	N	07.75	07.53	$Au_{23}SG_{18}$
	C	20.68	21.52	
	H	03.45	02.87	
	S	05.48	05.74	
Au_xOT_y	N	00.00	00.00	$Au_{33}OT_{22}$
	C	22.01	21.78	
	H	04.15	03.86	
	S	07.18	07.26	

Figure S2. EDAX spectra and corresponding elemental mappings of A) Au_xMPTS_y, B) Au_xSG_y and C) Au_xOT_y. Element C in data set A is from the carbon tape used as the substrate. The elemental mappings are overlayed with carbon for clarity. Elements Si, Sn and O in B and C in data sets B and C are from the conducting glass surface used as the substrate. The elemental mappings are overlayed with silicon for clarity**.** Table shows CHNS elemental analysis data of the three clusters.

Supporting information 3

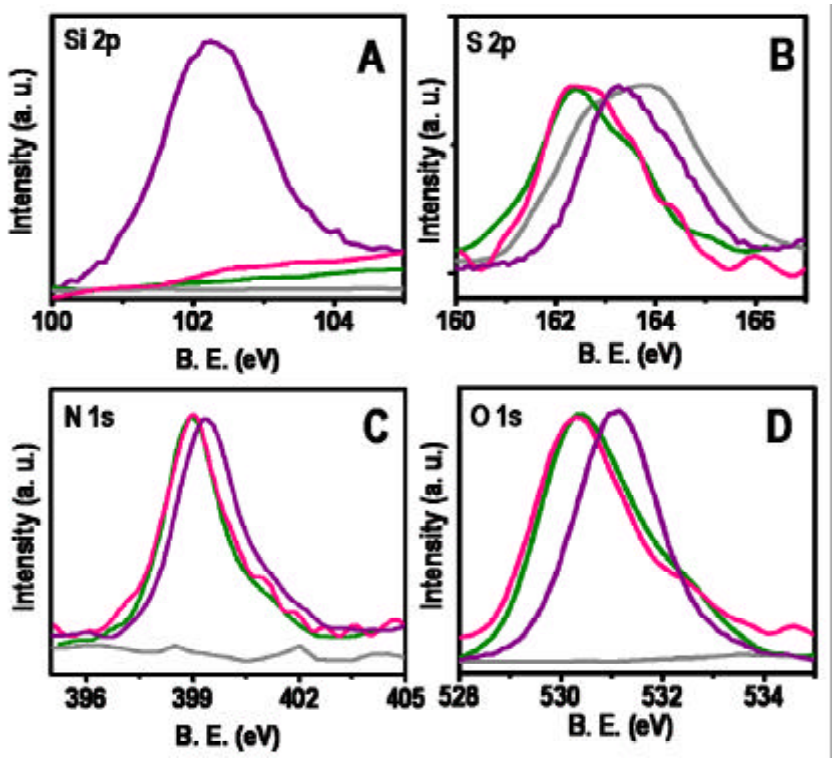


Figure S3. A) Comparison of XPS spectra due to the core level photoemission from Si2p, S2p , N1s and O1s of Au_{33} (grey trace), Au_{25} (green trace), Au_{23} (pink trace) and Au_{22} (purple trace).

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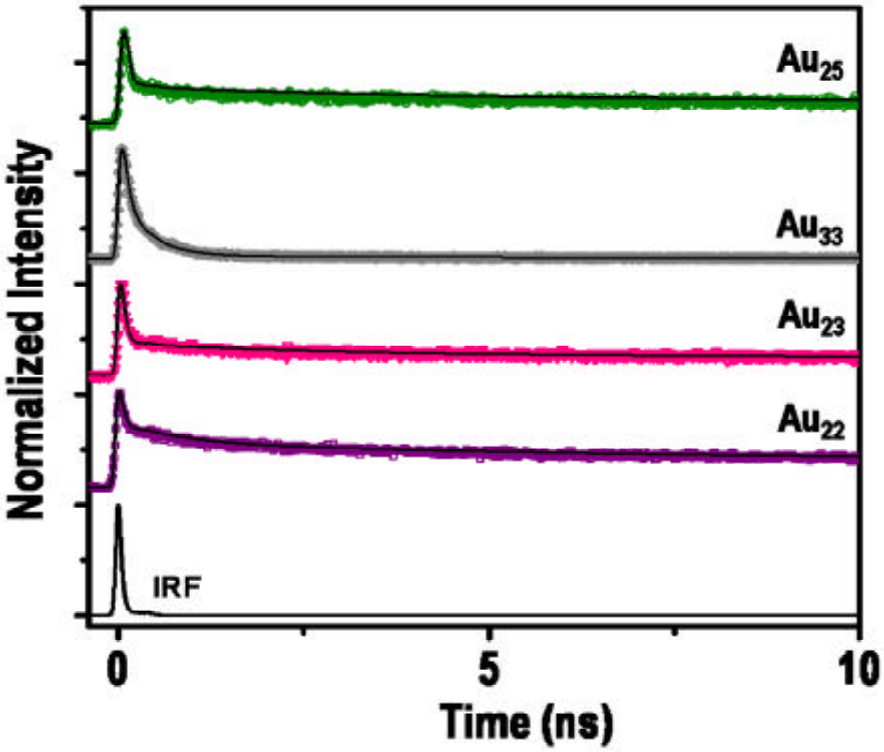

Figure S4. Fluorescence decay pattern of Au_{25}, Au_{33}, Au_{23}, and Au_{22} collected at 630 nm.

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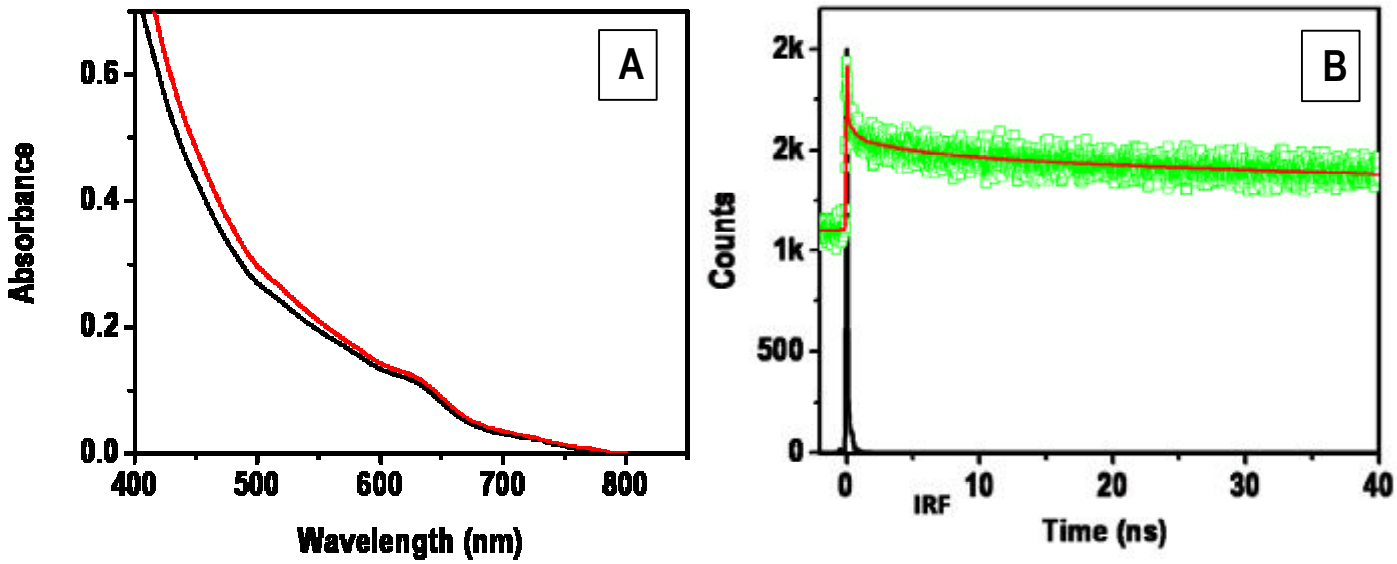

Solvent	t_1(ps)	%	t_2(ns)	%	t_3(ns)	%
Toluene	34	82.8	4.11	4.3	80.35	12.9
Water	39	92.4	2.41	3.6	68.55	3.9

Figure S5. A) Optical absorption spectra of Au_{23} before (red trace) and after (black trace) phase transfer. B) Fluorescence decay of Au_{23} after phase transfer. Table tabulates the life time values of the cluster before and after phase transfer.

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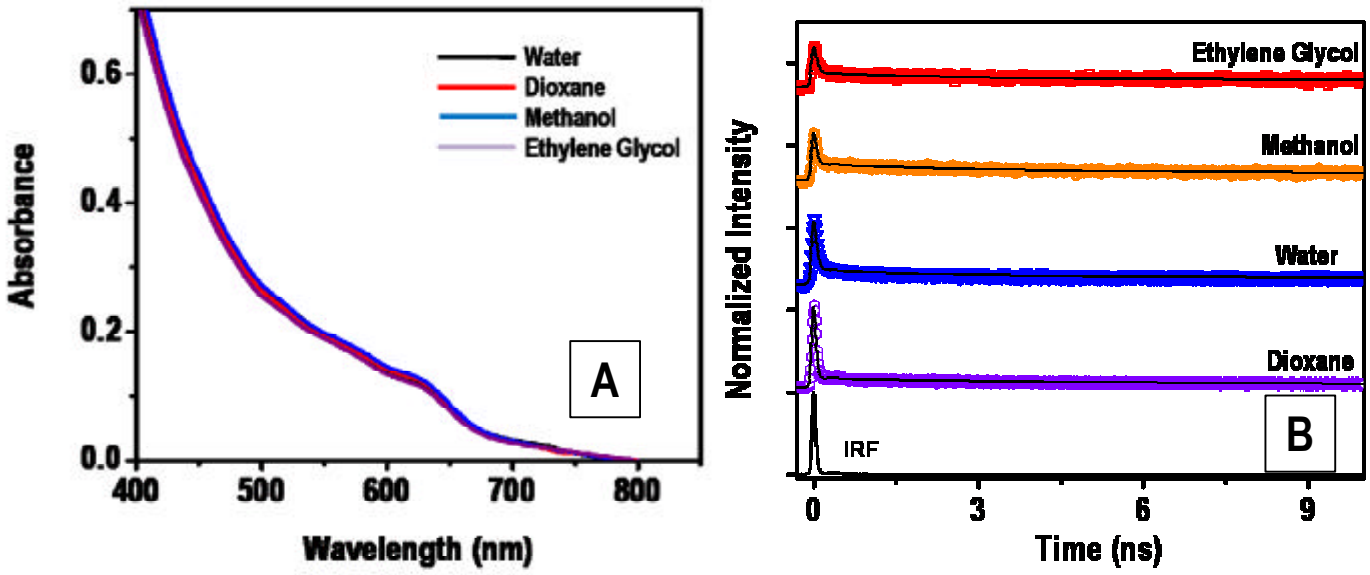

Solvent	t_1(ps)	%	t_2 (ns)	%	t_3 (ns)	%
Ethylene Glycol	47	86.5	2.67	5.5	70.06	7.9
Methanol	36	87.6	3.27	5.8	62.91	6.6
Water	39	92.4	2.41	3.6	68.55	3.9
Dioxane	16	98.0	5.07	1.1	31.63	0.9

Figure S6. A) Optical absorption spectra of Au_{23} in dioxane, water, methanol and ethylene glycol. B) Fluorescence decay of Au collected at 630 nm in various solvents. Table tabulates the life time of the cluster in various solvents.

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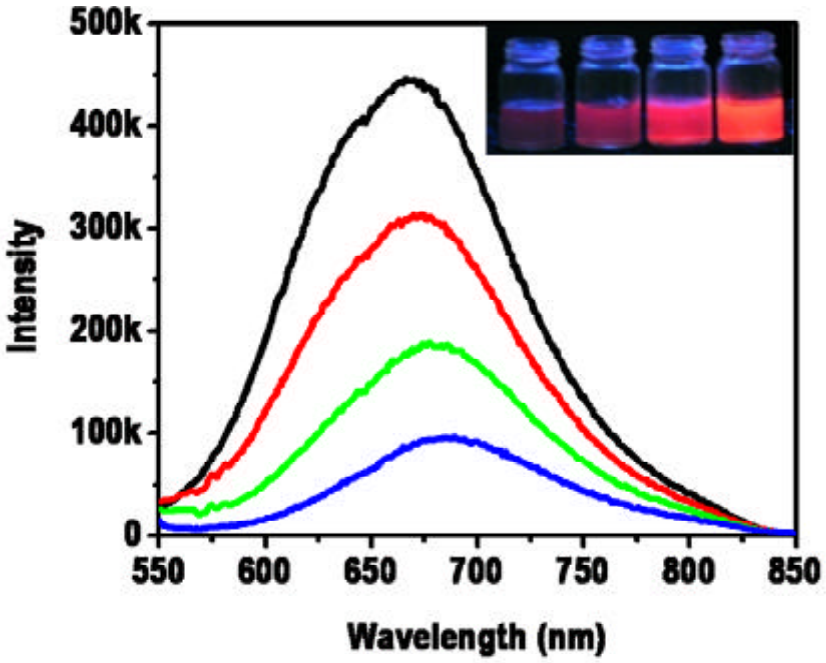

Figure S7. Plot of fluorescence intensity of Au_{23} cluster in water-DMSO mixture starting from pure water (blue line) to 1:1 (green line), 1:2 (red line) and 1:3 (black trace) water-DMSO mixtures. Inset shows the photographs of the corresponding solutions under UV light irradiation.

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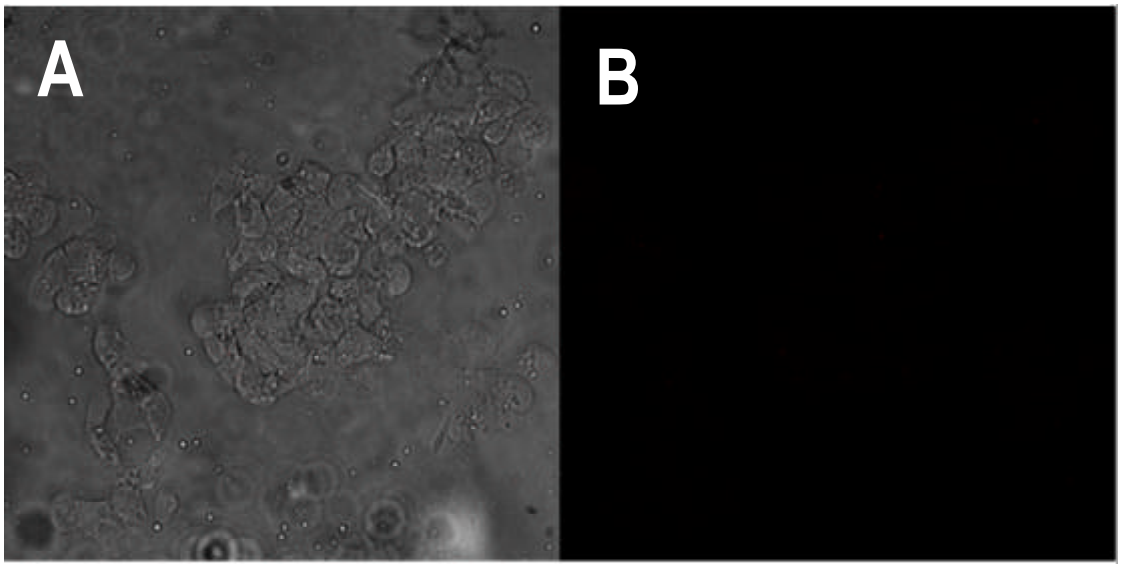

Figure S8. Bright field (A) and fluorescence (B) images of HepG2 cells stained with unconjugated Au_{23} clusters. No fluorescence was observed from the cells after washing.