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Tunable Upconversion in $ZnAl_{2-x}Ga_xO_4$: Er,Yb Phosphors by Modulating Al/Ga Ratio and Application in Optical Thermometry

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Table S1: Color coordinate values of $ZnAl_{2-x}Ga_xO_4$-Er, Yb (x=0, 0.25, 0.5,1, 1.5, 1.75, 2)

Sample name	**x**	**y**
1) $ZnAl_2O_4$-Er,Yb	0.56608	0.41800
2) $ZnGa_{0.25}Al_{1.75}O_4$- Er,Yb	0.51637	0.45332
3) $ZnGa_{0.5}Al_{1.5}O_4$- Er,Yb	0.48119	0.47773
4) $ZnGa_1Al_1O_4$- Er,Yb	0.46067	0.52073
5) $ZnGa_{1.5}Al_{0.5}O_4$- Er,Yb	0.40959	0.57249
6) $ZnGa_{1.75}Al_{0.25}O_4$- Er,Yb	0.42636	0.55911
7) $ZnGa_2O_4$- Er,Yb	0.40509	0.57957

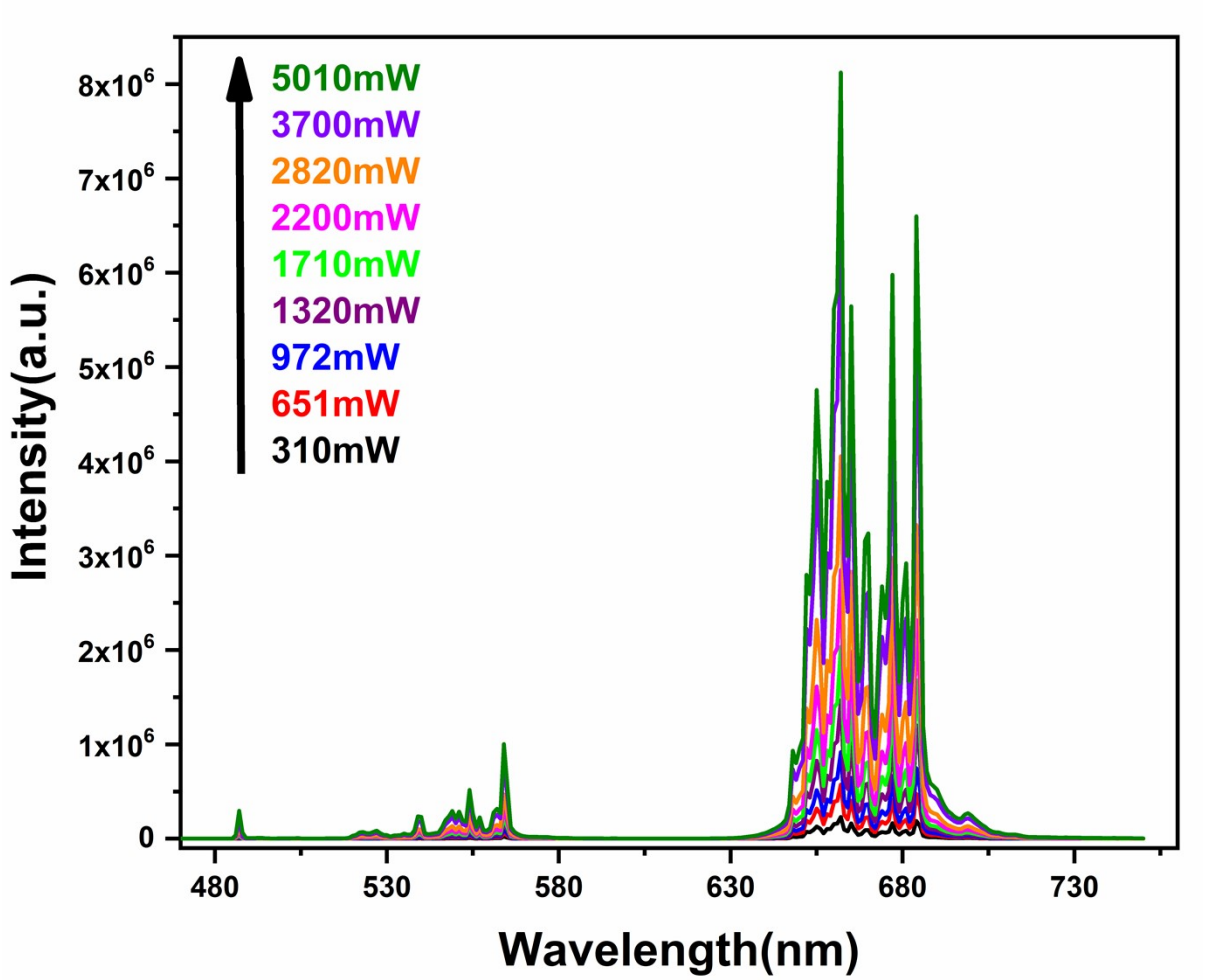

Figure S1: UC Emission spectra with various pump power of $ZnAl_2O_4$: Er,Yb

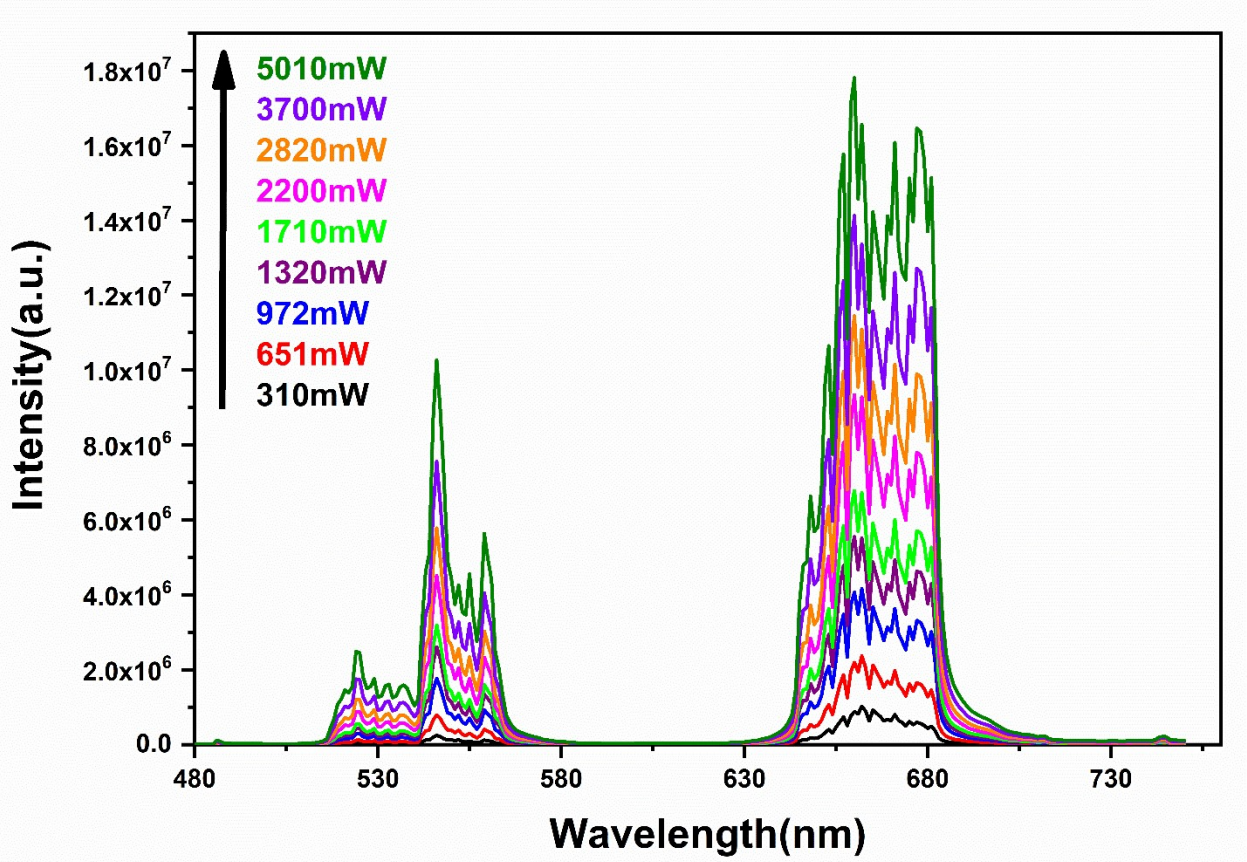

Figure S2: UC Emission spectra with various pump power of $ZnGa_2O_4$: Er,Yb

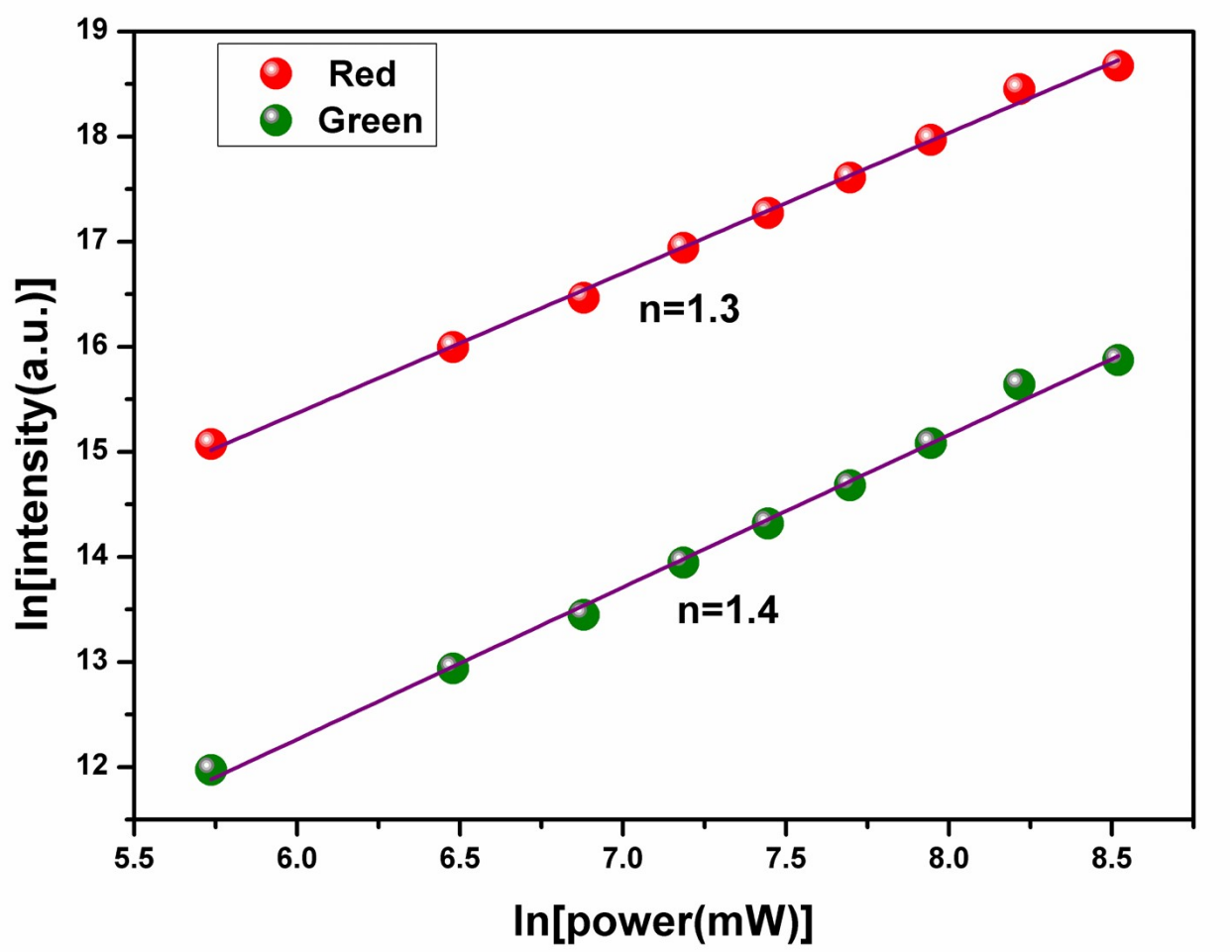

Figure S3: Dependence of pump power on green and red emission of $ZnAl_2O_4$: Er,Yb

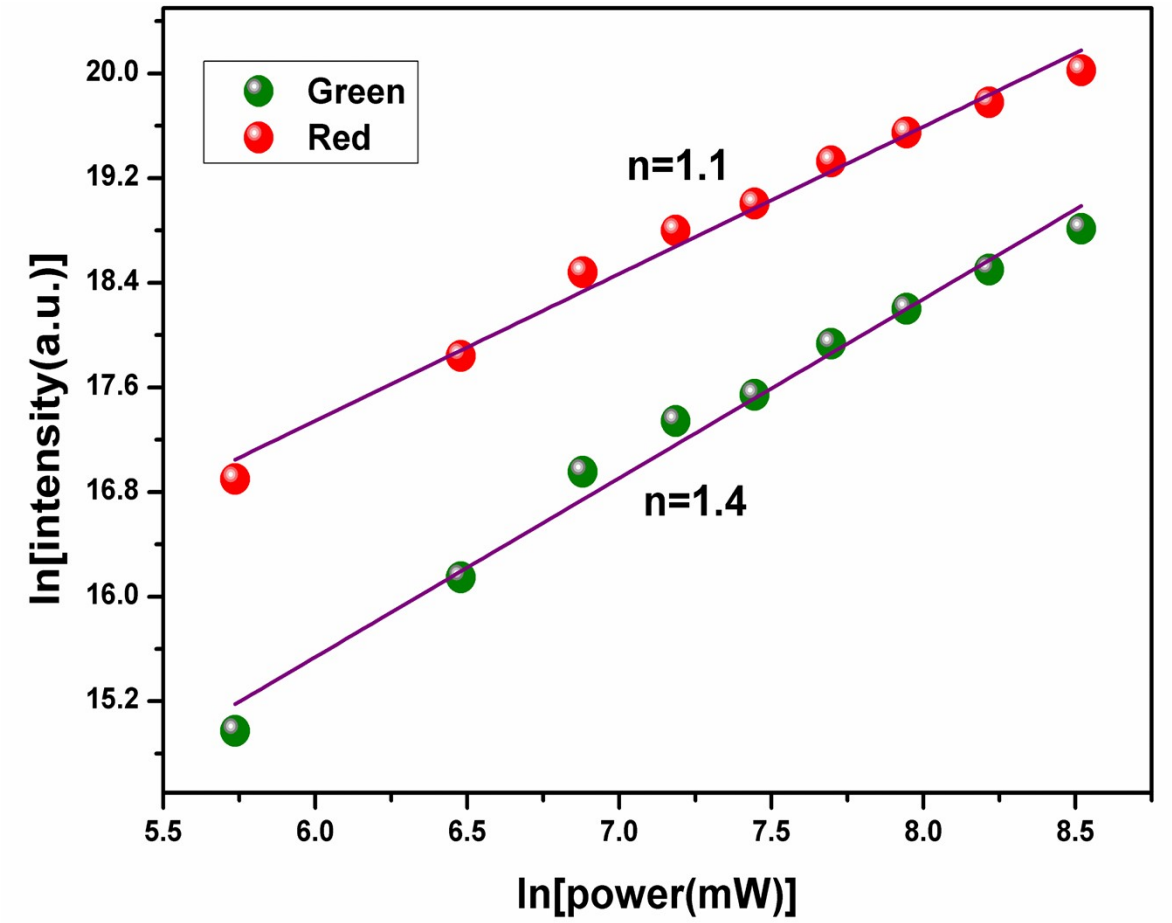

Figure S4: Dependence of pump power on green and red emission of $ZnGa_2O_4$: Er,Yb

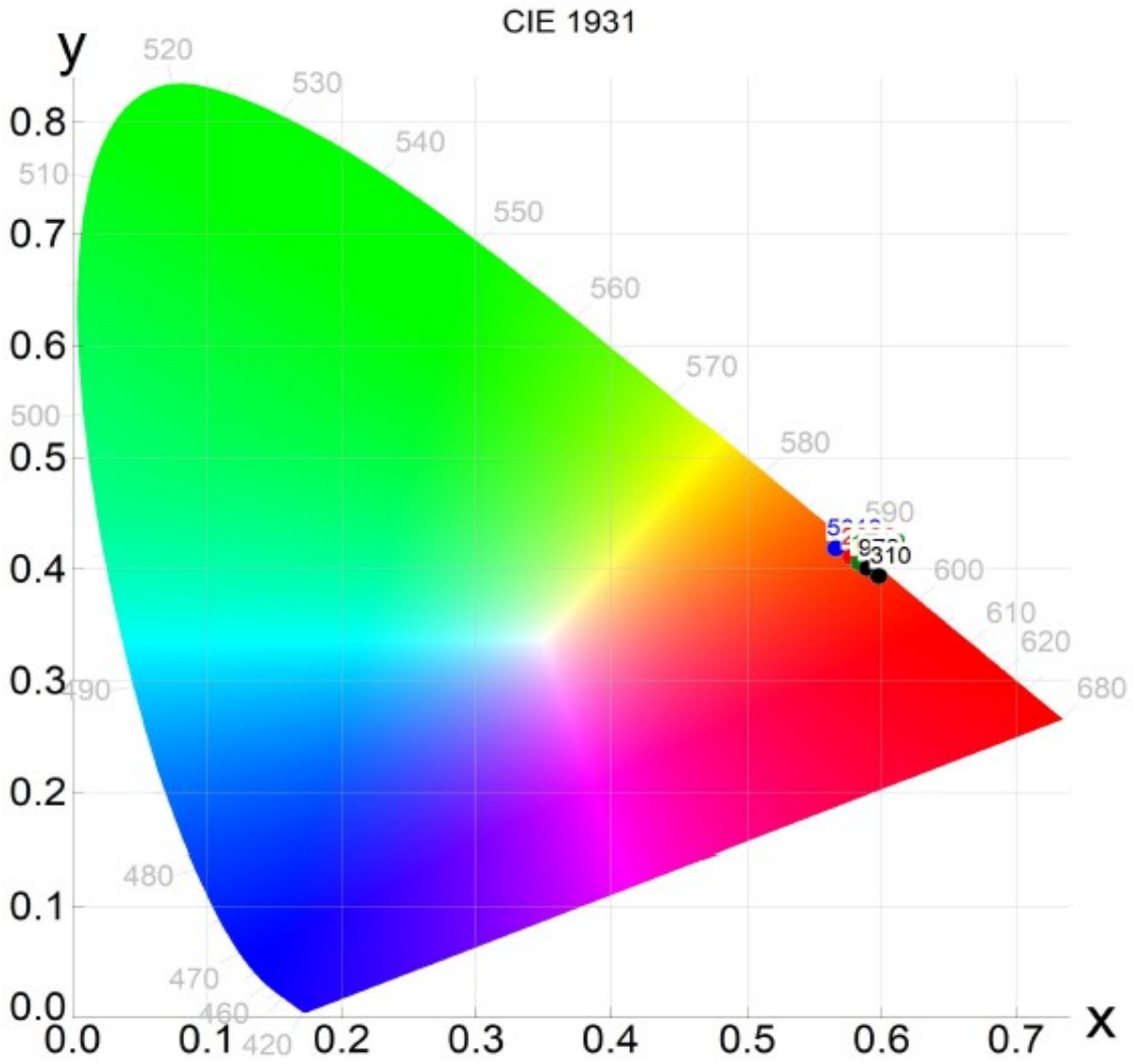

Figure S5: CIE Chromaticity diagram of $ZnAl_2O_4$: Er,Yb with different laser power of 310,972,1710,2820 and 5010mW

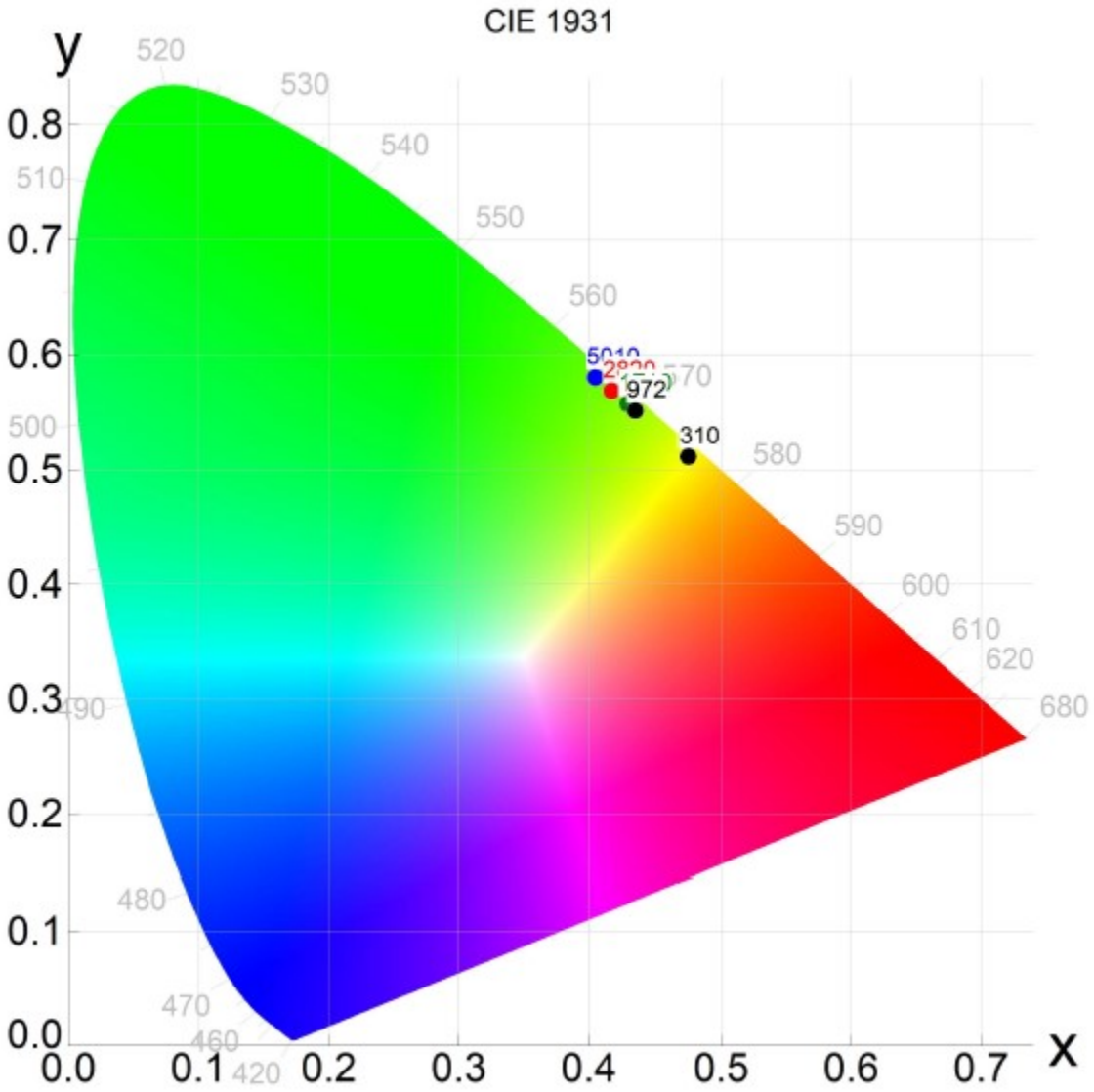

Figure S6: CIE Chromaticity diagram of $ZnGa_2O_4$: Er,Yb. with different laser power of 310,972,1710,2820 and 5010mW

Table S2. Average life time values of $ZnAl_1Ga_1O_4$: Er,Yb

Laser power (mW)	**τ_{av}(µs) λ_{ex}=980nm, λ_{em}=530 nm**	**τ_{av}(µs) λ_{ex}=980nm, λ_{em}=665 nm**
310	33.6	46.5
651	66.14	54.3
972	100.58	53.06
1320	123.5	60.12
1710	132.5	66.3
2200	137.7	68.1
2820	144.32	74.9
3700	150.5	80.7
5010	156.4	84.5

Table S3: Color coordinate values of $ZnAl_1Ga_1O_4$-Er,Yb

Laser power (mW)	**x**	**y**
310	0.51290	0.47289
972	0.49004	0.49644
1710	0.47926	0.50541
2820	0.46849	0.51444
5010	0.46067	0.52073