Table 8.1. *Characteristics of Some Optically Pumped Solid State Laser Systems*†.

Ion	Host	Laser wavelength (μm)	Lower laser level energy (cm^{-1})	Laser transition	Laser ion concentration %	τ_2 (ms)	$\Delta\nu$ (GHz)	Pulsed P or CW	Operating temperature (K)	Method of pumping
Cerium, Ce^{3+}	$LiYF_4$(YLF)	0.286	Variable - this is a tunable laser	$5d \rightarrow^2 F_{7/2}$	0.05	18 ns		P	300	KrF
Neodymium, Nd^{3+}	$Bi_4Ge_3O_{12}$	1.0638	∼2000	$^4F_{3/2} \rightarrow^4 I_{11/2}$	0.3			P low threshold	77	Xe
	CaF_2	1.0448	2034		0.4–0.6	1.1	270	P	120	Xe
	CaF_2–YF_3	1.0461	2032		0.2–12	0.48	900	P	300	Xe
	CaF_2–YF_3	1.0632	2170		0.2–12	0.48	2700	P	300	Xe
	$CaMoO_4$	1.061	∼2000		1.8	0.12	–	P or CW	300	Xe
	$Ca_5(PO_4)_3F$	1.063	1900		1	0.25	180	P or CW	300	Xe
	$CaWO_4$	0.9145	471	$^4F_{3/2} \rightarrow^4 I_{9/2}$	0.14–3	0.18	450	P	77	Xe
		1.0649	2016	$^4F_{3/2} \rightarrow^4 I_{11/2}$	0.14–3	0.18	210	P or CW	85	Hg
		1.3340	∼3970	$^4F_{3/2} \rightarrow^4 I_{13/2}$	0.14–3	0.18	600	P	300	Xe
		1.3370	∼3925		0.14–3	0.18	690	CW	300	Xe
	$CaY_2Mg_2Ge_3O_{12}$	1.05986	2008	$^4F_{3/2} \rightarrow^4 F_{11/2}$	2–6	0.305	1109	CW (high efficiency)	300	Ar^+ laser
	CeF_3	1.0638	2189	$^4F_{3/2} \rightarrow^4 I_{11/2}$	∼4	∼0.27	∼1050	P	300	Xe
	$GdGa_5O_{12}$ (GGG)	1.0621	2064		1	0.27	216	P	300	Xe
	$Gd_3Sc_2Al_3O_{12}$	1.06	1978		1	0.275	345	CW	300	W
	$Gd_3Sc_2Ga_3O_{12}$	1.0612	2070		1	0.26	420	P	300	Xe
	LaF_3	1.04065	1983		1-2	0.6–0.7	750	P or CW	300	Xe
		1.3310	4070	$^4F_{3/2} \rightarrow^4 I_{13/2}$	2	0.6–0.7	630	P	300	Xe

Table 8.1. *Characteristics of Some Optically Pumped Solid State Laser Systems (continued).*

Ion	Host	Laser wavelength (μm)	Lower laser level energy (cm^{-1})	Laser transition	Laser Ion concentration %	τ_2 (ms)	$\Delta\nu$ (GHz)	Pulsed P or CW	Operating temperature (K)	Method of pumping
Nd^{3+}	LaF_3	1.3310	4070	$^4F_{3/2} \rightarrow ^4 I_{13/2}$	2	0.6-0.7	630	P	300	Xe
	$LiYF_4$ (YLF)	1.0471	2042	$^4F_{3/2} \rightarrow ^4 I_{11/2}$		0.5	360	P	300	Xe
		1.0530			2	0.5	375	P	300	Xe
	$Lu_3Al_5O_{12}$	1.06425	2099		∼0.6	0.245	160	P or CW	300	Xe
	SrF_2	1.0370	2008		0.8	1.1	600	P	300	Xe
	$YAlO_3$	0.930	670	$^4F_{3/2} \rightarrow ^4 I_{9/2}$	1	0.18	900	P	300	XeF laser
		1.0795	2157	$^4F_{3/2} \rightarrow ^4 I_{11/2}$	1–3	0.18	330	P or CW (low threshold)	300	Xe
		1.0645	2026		1–3	0.18	285	P or CW	300	Xe
	$Y_3Al_5O_{12}$ (YAG)	0.8910	200	$^4F_{3/2} \rightarrow ^4 I_{9/2}$	1	0.255		P	300	Ar^+ laser
		0.8999	311		1	0.255		P	300	Ar^+ laser
		0.9385	852		1	0.255		P	300	Ar^+ laser
		0.09460	852		1	0.255	270	P	300	Xe
		1.06415	2110	$^4F_{3/2} \rightarrow ^4 I_{11/2}$	∼1	0.255	195	P or CW (low threshold)	300	Xe
		1.0682	2146		∼1	0.255	∼300	P	300	Xe
		1.3188	3222	$^4F_{3/2} \rightarrow ^4 I_{13/2}$	∼1	0.255	195	CW	300	Kr
		1.3382	4034		∼1	0.255	231	CW	300	Kr
		1.3564	∼4000		∼1	0.255	–	CW	300	Kr
		1.4140	∼4000		∼1	0.255	–	CW	300	Kr

Table 8.1. *Characteristics of Some Optically Pumped Solid State Laser Systems (continued).*

Ion	Host	Laser wavelength (μm)	Lower laser level energy (cm^{-1})	Laser transition	Laser ion concentration %	τ_2 (ms)	$\Delta\nu$ (GHz)	Pulsed P or CW	Operating temperature (K)	Method of pumping
	Y_2O_3	~1.0746	1895	$^4F_{3/2} \rightarrow ^4 I_{11/2}$	1.5	0.34	240	CW (very low threshold)	300	Kr^+ laser
		~1.358	3837	$^4F_{3/2} \rightarrow ^4 I_{13/2}$	1.5	0.34	360	CW (very low threshold)	300	Kr^+ laser
	$Y_3Sc_2Ga_3O_{12}$	1.0583	~2000	$^4F_{3/2} \rightarrow ^4 I_{11/2}$	1		240	P	300	Xe
		1.3310	~4000	$^4F_{3/2} \rightarrow ^4 I_{13/2}$	1		420	P	300	Xe
Nd^{3+}	YVO_4	1.0625	1964		~1	0.092		P	300	Xe
		1.0634	~2000		~1	0.092	210	CW	300	Ar^+ laser
		1.3425	3913		0.1	0.033	240	P	300	Xe
Holmium Ho^{3+}	CaF_2-ErF_3(3%)	2.06	~ 250	$^4I_7 \rightarrow ^5 I_8$	0.5–1			P	298	Xe
	$LiYF_4$ (YLF)	0.7505	~5300	$^5S_2 \rightarrow ^5 I_7$	2	0.09	360	P	300	Xe
		0.9794	~5300	$^5F_5 \rightarrow ^5 I_7$	2	0.1	360	P	90	Xe
		1.3960	~11300	$^5S_2 \rightarrow ^5 I_5$	2	0.05		P	300	Xe
	$LaYF_4$ (+5% Er)	2.066	300	$^5I_7 \rightarrow ^5 I_8$	2			P	300	Xe
	$Li(Y,Er)F_4$ (+6.7% Tm)	2.0654	~ 300	$^5I_7 \rightarrow ^5 I_8$	1.7	12		P	300	Xe
	$Lu_3Al_5O_{12}$ (+10% Yb, 0.3% Cr)	2.9460	~5400	$^5I_6 \rightarrow ^5 I_7$	10		270	P	300	Xe
	$Y_3A\ell_5O_{12}$ (YAG)	2.0914	532	$^5I_7 \rightarrow ^5 I_8$	~4	4-5		P	77	Xe
		2.9403	~5400	$^5I_6 \rightarrow ^5 I_7$	10		270	P	300	Xe
	YAG + 50% Er	~2.13	532	$^5I_7 \rightarrow ^5 I_8$	1.65	5		P	300	Xe
	6-7% Tm							CW	77	W

Table 8.1. *Characteristics of Some Optically Pumped Solid State Laser Systems (continued).*

Ion	Host	Laser wavelength (μm)	Lower laser level energy (cm^{-1})	Laser transition	Laser ion concentration %	τ_2(ms)	$\Delta\nu$ (GHz)	Pulsed P or CW	Operating temperature (K)	Method of pumping
Erbium ER^{3+}	CaF_2	2.7307	∼6500	$^4I_{11/2} \rightarrow ^4 I_{13/2}$	4			P	300	Xe
	$LiYF_4$ (YLF)	0.85	6714	$^4S_{3/2} \rightarrow ^4 I_{13/2}$	2	0.2	300	P	300	Xe
		∼1.2308	10313	$^4S_{3/2} \rightarrow ^4 I_{11/2}$	2	0.2		P	300	Xe
		1.7320	12572	$^4S_{3/2} \rightarrow ^4 I_{9/2}$	2	0.2		P	300	Xe
		2.870	6738	$^4I_{11/2} \rightarrow ^4 I_{13/2}$	2	10		P	300	Xe
Er^{3+}	$Lu_3Al_5O_{12}$	0.86325	6818	$^4S_{3/2} \rightarrow ^4 I_{13/2}$	1.5	0.13	240	P	300	Xe
		1.6525	534	$^4I_{13/2} \rightarrow ^4 I_{15/2}$	2–5	6–7	195	P	77	Xe
		1.7762	12772	$^4S_{3/2} \rightarrow ^4 I_{9/2}$	1.5	0.11		P	300	Xe
		2.8298	6885	$^4I_{11/2} \rightarrow ^4 I_{13/2}$	∼33	0.12		P	300	Xe
	+5%Yb, 0.3%Cr	2.8298	∼6885	$^4I_{11/2} \rightarrow ^4 I_{13/2}$	33	0.12		P (low threshold)	300	Xe
	$Y_3Al_5O_{12}$ (YAG)	0.8627	∼6800	$^4S_{3/2} \rightarrow ^4 I_{13/2}$	2.5	0.12		P	300	Xe
		2.8302	∼6800	$^4I_{11/2} \rightarrow ^4 I_{13/2}$	33	0.09		P (low threshold)	300	Xe
Thulium Tm^{3+}	$LiYF_4$ (YLF)	0.4526	5969	$^1D_2 \rightarrow ^3 F_4$	10	0.001	8990	P	300	XeF laser
	$YAlO_3$ (+ 1% Cr)	2.34	8250	$^3F_4 \rightarrow ^3 H_5$	1	∼0.1		P	300	Xe
	Y_3AlO_{12} (YAG) + 0.1% Cr	2.324	~8300	$^3F_4 \rightarrow ^3 H_5$	1			CW	300	W

Table 8.1. *Characteristics of Some Optically Pumped Solid State Laser Systems (continued).*

Ion	Host	Laser wavelength (μm)	Lower Laser level energy (cm^{-1})	Laser transition	Laser Ion concentration %	τ_2 (ms)	$\Delta\nu$ (GHz)	Pulsed P or CW	Operating temperature (K)	Method of pumping
Chromium	Al_2O_3	0.6943(R_1)	0	${}^2E(\overline{E}) \rightarrow {}^4A_2$	∼0.05	3	∼300	P	300	Xe
Cr^{3+}	(sapphire)	0.6929(R_2)	0	${}^2E(2\overline{A}) \rightarrow {}^4A_2$	∼0.05	3	225	P	300	Xe
		0.6943(R_1)	0	${}^2E(2\overline{A}) \rightarrow {}^4A_2$	∼0.05	3	∼300	CW	300	Hg
	$BeAl_2O_4$	0.701→0.818	varies	${}^4T_2 \rightarrow {}^4A_2$		0.26		P	300	Xe
	(alexandrite)	0.744 → 0.788	varies	${}^4T_2 \rightarrow {}^4A_2$	0.27	0.26		CW	300	Hg
Cobalt (Co^{2+})	MgF_2	1.63→2.11 tunable	varies	${}^4T_2 \rightarrow {}^4T_1$	.9			CW	80	Nd:YAG laser
Nickel		1.674→1.676	varies	${}^3T_2 \rightarrow {}^3A_2$	.5	11.5		P	82→100	
($N_i{}^{2+}$	MgF_2	1.731→1.756	varies						100→192	
		1.785→1.797	varies						198→240	
Ti^{3+}	Al_2O_3	0.66–1.1	varies					CW	300	Ar^+ laser
		0.66–1.38						pulsed		frequency doubled Nd:YAG laser

†Abstracted from a more comprehensive listing in *Handbook of Laser Science and Technology*, M.J. Weber, Ed., Vol. I, *Lasers and Masers*, CRC Press, Boca Raton, FL, 1982.