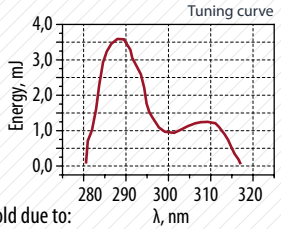
Tunable Ce:LiCaAlF$_6$ and Ce:LiLuYF$_4$ solid-state lasers

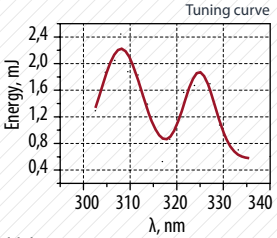
Parameter	Ce:LiLuYF$_4$	Ce:LiCaAlF$_6$
Active Medium	LiYF$_4$:Ce^{3+} with Lu^{3+} and other RE ions	LiCaAlF$_6$:Ce^{3+}
Tuning range, nm	304–334	280–317
Linewidth, nm	0,15	
Slope efficiency	20 % (311 nm)	20 % (290 nm)
Saturation, mJ/cm^2	70±5	100±15
Pulse duration, ns	7 *picosecond option available*	
Beam divergence, mrad	1,2	
Size LxWxH, mm	425x160x80	
Weight, kg	5	

Tunable Ce:LiCaAlF$_6$ laser

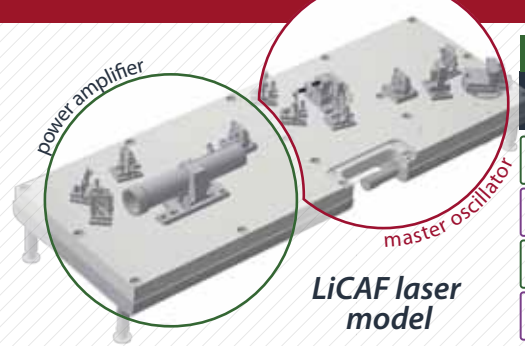


- Output UV laser oscillation with tuning from 280 nm to 317 nm;
- Pumped by 266 nm (4th harmonic Nd:YAG) or any pulsed lasing of the range 250–270 nm;
- Amplifies ultrashortpulses of UV spectral range;
- Scales power of laser output up to destruction threshold due to:
  - amplification stages arrangement;
  - pulse shortening;
- Independent on pump source characteristics.

Tunable Ce:LiLuYF$_4$ laser



- Output UV laser oscillation with tuning from 304 nm to 334 nm;
- Free from solarization;
- Pumped by 297 nm (LiCAF) or any pulsed lasing of the range 240–255 nm and 290–305 nm;
- Amplifies ultrashort pulses of UV spectral range;
- Scales power of laser output up to destruction threshold due to:
  - amplification stages arrangement;
  - pulse shortening;
- Independent on pump source characteristics.



LiCAF laser model

Benefits

- Continuous tuning in the ranges 280 nm – 317 nm and 304 nm – 334 nm (according to active element)
- High stability of laser emission parameters
- Operation at high repetition rates (Hudreds of kHz)
- Short pulses generation option (hundreds of picoseconds)
- Short pulses amplification (femtoseconds)
- Independent on temperature, no cooling needed
- Low cost of tuning automation (+ 20 % of price)
- Easy to use

Physical principles

Yang and DeLuca, Appl.Phys.Lett., 31, 594 (1977)

- Lasing transitions — 5d-4f transitions of Ce^{3+} ions in fluoride crystals
- Electrical-dipole allowed
- Localized in UV and VUV spectral ranges
- High fluorescence quantum yield
- Wide bands (40 nm due to vibronically broadened)
- Significant Stokes shift
- High values of working transitions cross-sections
- Degradation excluded of active medium due to wide band-gap and inhibition of photodynamic processes

Pumping source characteristics			LiCAF lasers and amplifiers		Output laser characteristics [1]		
pump source	pulse duration	pulse energy range	MO	MOPA	pulse duration	pulse energy range	wavelength range
Nd-laser [2ω$_0$]	10 ns	100–300 mJ	●	○	8 ns	10 mJ	282–315 nm
Nd-laser [4ω$_0$]	10 ns	30–100 mJ	●	○	8 ns	10 mJ	282–315 nm
Nd-laser [2ω$_0$]	10 ns	200–1000 mJ	○	●	8 ns	70 mJ	282–315 nm
Nd-laser [4ω$_0$]	10 ns	30–200 mJ	○	●	8 ns	70 mJ	282–315 nm
Pumping source characteristics			**LiLuYF$_4$ lasers and amplifiers**		**Output laser characteristics [1]**		
LiCAF laser [2]	10 ns	70 mJ	○	●	8 ns	40 mJ	305–335 nm

LiCAF BASED DEEP UV TUNABLE LASER SYSTEM

Pumping source characteristics			LiCAF lasers and amplifiers		Output laser characteristics [1]		
Nd-laser [1ω$_0$, 2ω$_0$]	10 ns	200–1000 mJ	○	●	8 ns	70 mJ	282–315 nm
Nd-laser [1ω$_0$, 4ω$_0$]	10 ns	30–200 mJ	○	●	8 ns	7 mJ	210–220 nm

ULTRASHORT PULSES AMPLIFIERS

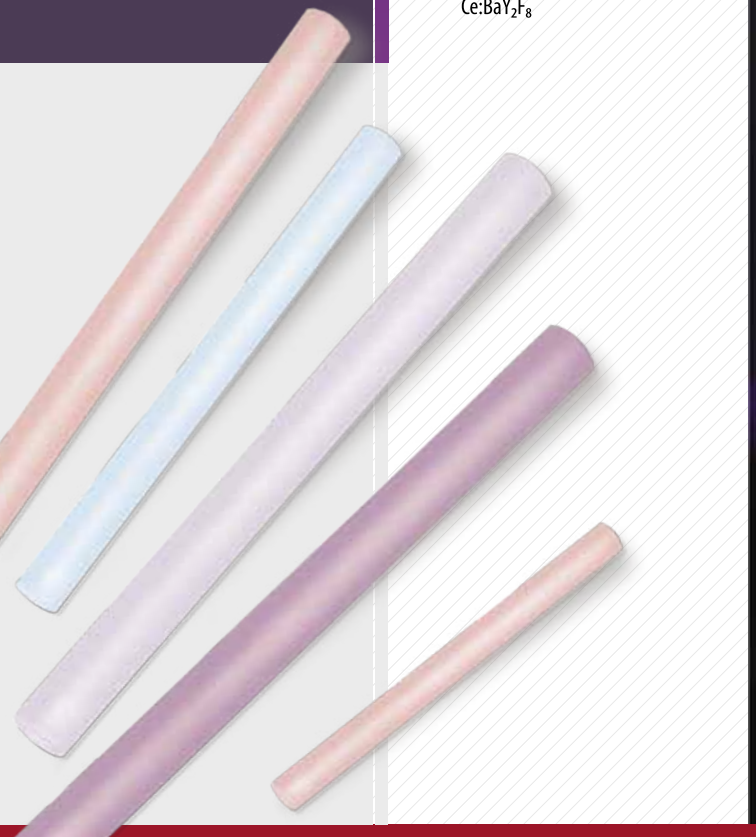
Pumping source characteristics			LiCAF lasers and amplifiers		Output laser characteristics [1]		
Nd-laser [2ω$_0$]	10 ns	200–1000 mJ	○	●	700 ps	10 mJ	282–315 nm
Nd-laser [4ω$_0$]	10 ns	30–200 mJ	○	●	700 ps	10 mJ	282–315 nm
Nd-laser [2ω$_0$]	ps	200 mJ	○	●	ps	20 mJ	282–315 nm
Nd-laser [4ω$_0$]	ps	30–70 mJ	○	●	ps	20 mJ	282–315 nm
Pumping source characteristics			**LiLuYF$_4$ lasers and amplifiers**		**Output laser characteristics [1]**		
KrF [248 nm]	10 ns	50–500 mJ	○	●	700 ps	50 mJ	305–335 nm
XeCl [308 nm]	10 ns	50–500 mJ	○	●	700 ps	50 mJ	309–335 nm
LiCAF laser [2]	8 ns	70 mJ	●	○	700 ps	40 mJ	282–315 nm

[1] At tuning maximum [2] Using laser pumped LICAF laser
All lasers could be equipped with stages of solid state amplifiers

MO master oscillator MOPA master oscillator power amplifier

Fluoride crystals for active and passive optical elements

Ultraviolet Solutions company offers wide range of crystalline compounds of fluorides, pure and doped with various rare earth and transition metal ions. Crystals for laser active media, with high active ions content (up to 4 at. %)



IR spectral range

Rare-earth doped

- $LiYF_4$
- $CaF_2 – YF_3$
- $BaF_2 – LaF_3$
- $Na_4Y_6F_{22}$

Transition metal ions doped

- MgF_2
- $KMgF_3$
- $KZnF_3$

UV spectral range

- $Ce:LiLuF_4$
- $Ce:LiLuYF_4$
- $Ce:LiCaAlF_6$
- $Ce:LiSrAlF_6$

Novel active media for UV spectral range

- $Ce:KY_3F_{10}$
- $Ce:BaY_2F_8$

Ultraviolet Solutions LLC
420100, Pobedi Ave 184-65, Kazan,
Russia
Phone: +7 (917) 2376243
E-mail: ultravioletsol@mail.ru
www.uvsol.net

Ultraviolet solutions

Tunable $Ce:LiCaAlF_6$ and $Ce:LiLuYF_4$ solid-state lasers

The new class UV lasers

Ultraviolet solutions