Lasers – Examples I: Ruby

(a) Mirror 1
Beam
Propagation

(b) Mirror 2

(c) Ruby
Trigger electrode
Flashtube
Beam

(d) Energy, eV
Pump levels
E3
Fast (nonradiative)
transition
E2
Metastable state
Pump radiation
Laser output 694.3 nm
E1
Ground state

Flashlamp
Short laser pulses
Threshold

Time, ms
0 1 2 3

Intensity
Lasers – Examples II: HeNe

Non-radiative transition

Stimulated emission (laser output 632.8 nm)

Spontaneous emission (~600 nm)
Lasers – Examples III: Diode

Shuji Nakamura with a blue laser, one application of his co-invention. His work was valued at $500m in 2001 – he was offered $200. Photo: Randall Lamb/UCSB/EPA
Lasers – Examples IV: FEL
Lasers – Examples IV: FEL

A schematic of the FEL is shown above.

Jefferson Lab FEL Output Light Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>IR Branch</th>
<th>UV Branch</th>
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</thead>
<tbody>
<tr>
<td>Wavelength range (microns)</td>
<td>1.5 - 14</td>
<td>0.25 - 1</td>
</tr>
<tr>
<td>Bunch Length (FWHM psec)</td>
<td>0.2 - 2</td>
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</tr>
<tr>
<td>Laser energy / pulse (microJoulesJ)</td>
<td>100 - 300</td>
<td>25</td>
</tr>
<tr>
<td>Laser power (kW)</td>
<td>&gt; 10</td>
<td>&gt; 1</td>
</tr>
<tr>
<td>Repetition Rate (cw operation, MHz)</td>
<td>4.7 - 75</td>
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