

Update on the Air Force Research Lab Sum-Frequency Sodium Laser



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I'm reporting on material from John Telle and his colleagues

- E-mails and a paper:

“20 Watt CW All-Solid-State 589-nm Sodium Beacon
Excitation Source Based on Doubly Resonant Sum-
Frequency Generation in LBO” by

Joshua C. Bienfang, Craig A. Denman, Brent W. Grime,
Paul D. Hillman, Gerald T. Moore, and John M. Telle

Presented at the Advanced Solid-State Photonics
Conference



Solid-state sum-frequency laser

- Uses two laser modules built by Lightwave Electronics Corporation
 - 1064 nm and 1319 nm
 - Diode-pumped, Nd:YAG rod amplifiers
- Sum-frequency generation using LBO crystal is done inside a resonant cavity, to increase efficiency
 - Several hundred W to 1 kW of IR light circulating in cavity
- Laser producing ~ 20W of 589 nm light
- Pulse format CW, but have produced pulses by chopping inside the sum-frequency cavity
 - Chopped at 8000 RPM = 133 Hz



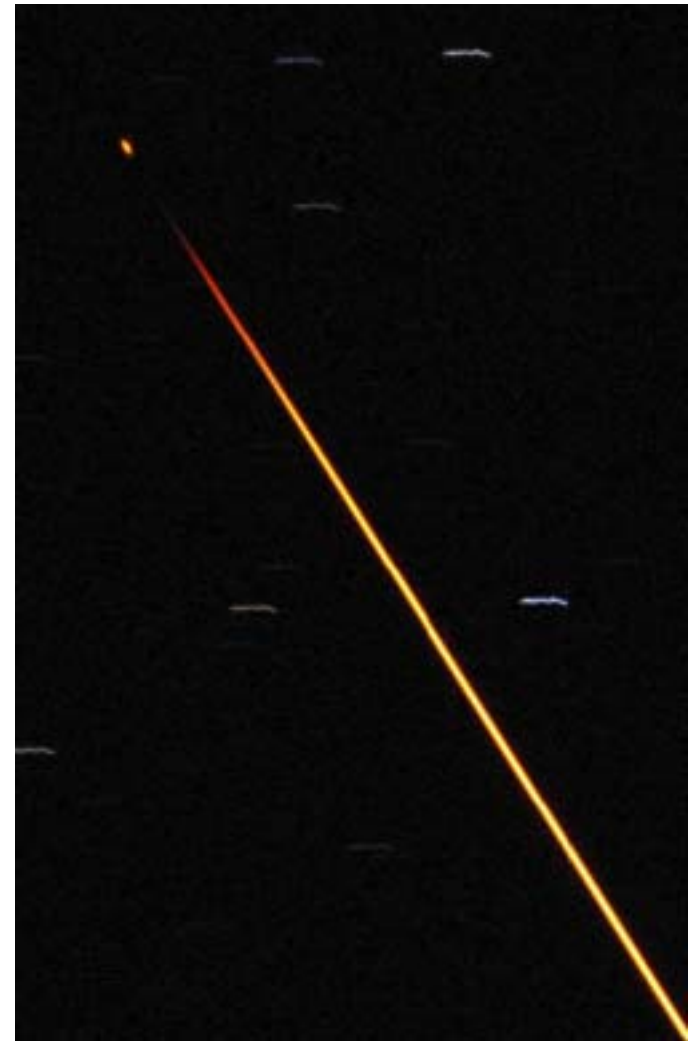
Laser appears to be robust

- Excellent beam quality
- Has run for ~ 100 hours without problem
- Stays on D2 line of sodium for several hours, once laser is warmed up
 - Can be re-tuned in < 1 minute



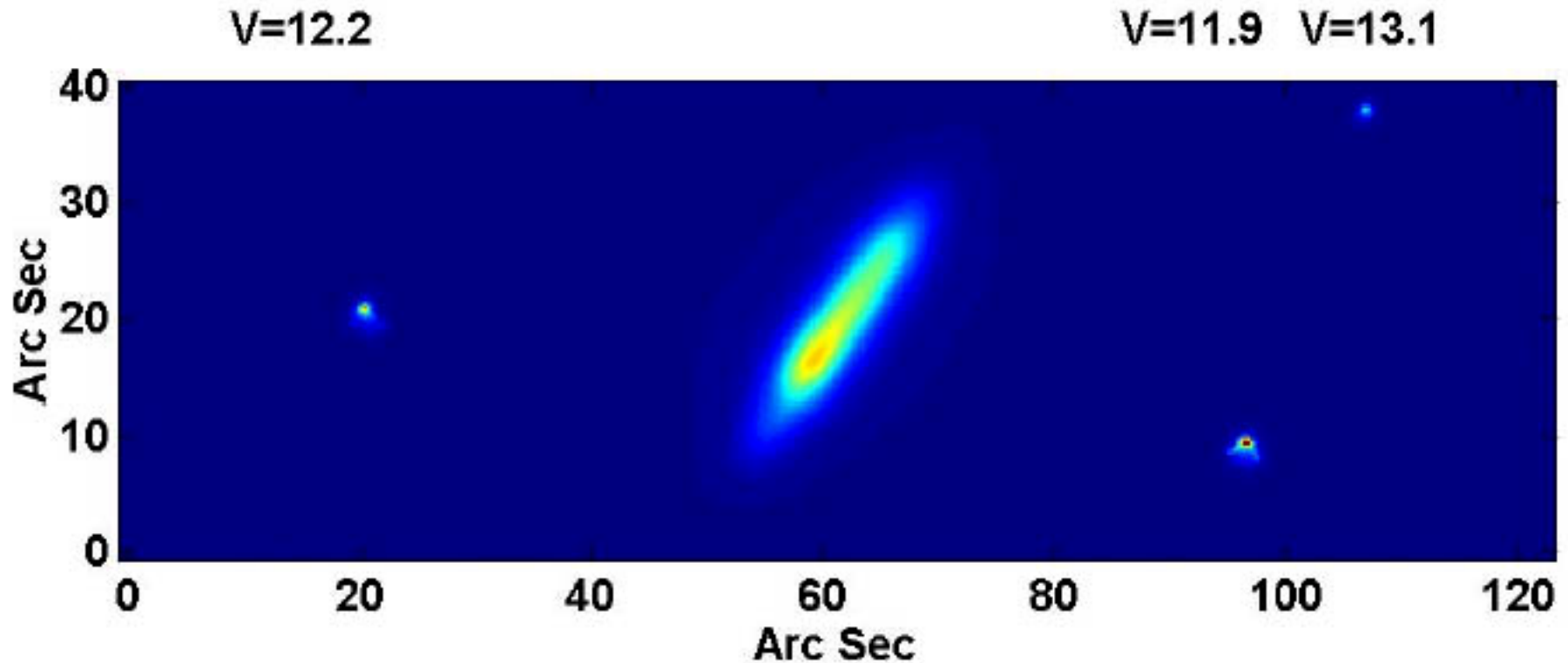
“First light” on sky Nov 2002

- Projection telescope rather crude for these preliminary experiments
- Projected ~ 10 W
 - Beam director's optical coatings optimized for other λ 's
- Made 7.5 mag (equiv.) star
- Last week: tried circular polarization
 - Increased return power by 70%-100%





Spot diameter ~ 4 arc sec



- Not clear why spot was so big, if beam quality was measured to be “excellent”
- Presumably the beam director is at fault



Future plans

- Use “real” beam director
- Circular polarization
- Next laser: 50 watts (!)



Things I'd like to understand

- How versatile can pulse format be (to deal with spot elongation for 30-m telescopes)?
- What is the real beam quality?
- How complex is this laser to run?
- How robust is it?
- What are prospects for industry to be interested in producing more of these lasers?
 - Rumors that Lightwave is not interested in building any more
 - Can other companies take over?
- Overall: what should the astronomical community be doing about this laser?