Center for Adaptive Optics
4th Laser Technology and Systems for Astronomy Workshop
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Lake Arrowhead, CA

## Abstracts

**Review of the laser technical specifications for the 4LGSF lasers**
Authors D.Bonaccini Calia, Pierre-Yves Madec/ ESO

Abstract:
we have recently prepared and issued the technical specifications of the laser to be procured for the ESO 4LGSF project. We would like to outline and discuss the justifications for some of the specifications, among the 224 defined.

**Status of the ESO fiber laser development program**
Authors: D.Bonaccini Calia, Y.Feng, L.Taylor, W.Hackenberg, R.Holzlohner

Abstract:
We report on the current status of the ESO fiber laser development program, and the recent breakthorugh in narrow-band Raman fiber amplifier which has been frequency doubled to 589nm.

**Status update on the LLNL 589nm fiber laser system**
Author: Jay Dawson, LLNL

Abstract:
Update on the current status of the CfAO-AODP LLNL fiber laser system.

**A Cursory View of the Beacon Brightness**
Author: Craig Denman, craig@fasortronics.com, FASORtronics LLC, Albuquerque, New Mexico

Abstract**:**
In this talk, we will look at the equation for the beacon radiance return and consider its parts in terms of their functional dependencies with a comparison to the available data. The purpose of this expeditious approach is not to explicitly avoid the "deep dive" into the physics but, instead, to obtain plots of radiance versus power, seeing conditions, observing direction, observatory location, etc. in the quickest way possible. Different laser types are considered for New Mexico, Hawaii, and Chile. One must keep in mind the approximate nature of the calculations and the lack of data for calibrations of the analytic expressions though enjoy the instructive nature of the cursory view.

**Specifications for ideal sodium guidestars for ELTs**
Author: D. Gavel

Abstract:

This will be a summary of the deliberations from previous workshops and results from the Analysis and Modeling effort within CfAO's Theme 2. We discuss the desired characteristics of the laser guidestar and laser system from the perspective of adaptive optics system performance and observatory operations.

**Monte Carlo rate equation simulations of LGS return flux**
Authors: R. Holzlohner, D. Bonaccini Calia, W. Hackenberg (all at ESO)

Abstract:

We report on our Monte Carlo rate equation simulations on the return flux for several laser formats considered for LGS systems at astronomical observatories. We model a single sodium atom and follow its state evolution under laser radiation and atomic collisions. The simulation takes into account all 24 states of sodium, optical polarization, optical pumping, saturation, spontaneous and stimulated emission, and the geomagnetic field.

**Bloch equation simulation of LGS return flux**
Authors: R. Holzlohner, D. Bonaccini Calia, W. Hackenberg (all at ESO)

Abstract:

Monte Carlo rate equation simulations of LGS return flux are easy to understand and to program, but they may have certain limitations in their validity, e.g. in the presence of strong fields or some modulated laser formats. In order to obtain quantitatively correct results, a comparison with Bloch equations, also known as density matrix equations, is required. We report on our activities and show some first results.

**Hybrid Nd:YAG / Yb:Fiber Guide Star Laser Architecture with Easily Varied Spectrum**
Author: Thomas J Kane, FASORtronics LLC & Ginzton Laboratory, Stanford University, Tomkane@Stanford.edu

Abstract:

The return photon flux from a mesospheric sodium guide star resonantly excited by a pure, single-frequency laser is predicted to exhibit saturation in the best seeing at moderate laser powers. Added spectral features, such as power at the D2b line or broadened linewidth, is expected to increase return. We propose a CW sum-frequency-generation architecture where the 1064-nm power is based on amplification in Yb:Fiber. A waveguide modulator makes it easy to arbitrarily modulate the input to the amplifier. Conversion to 589 nm takes place when the 1064-nm light makes a single pass through a nonlinear crystal which also contains a strong single-frequency resonant field from a 1319-nm Nd:YAG laser. The modulation of the 1064-nm light will be present on the 589-nm output.

**The Physics of the Sodium atom in the mesosphere- an overview**

Author: Ed Kibblewhite, U. Chicago

Abstract:

The photon return/watt of laser power depends on the spectral and temporal format of the laser and the interaction of the atom with other atoms/molecules and the earth's magnetic field. I will review these effects and give results of calculations that compare some different types of laser.

**Liouville Space Modeling of Sodium Guidestars**

Authors: S. W. Morgan, Y.-Y. Jau, and W. Happer, Princeton University

Abstract:

I will discuss our group's modeling of the return flux from a sodium guidestar. This modeling is an extension of models our group uses for experiments with alkali metal atoms in our lab. Our modeling calculates using Liouville space and includes such effects as optical pumping (cw and modulated excitation), magnetic fields, and S-damping collisions with oxygen.

**LMCT progress on on AODP pulsed guidestar laser**

Author: Allen Tracy, LMCT

**Gemini South / Keck Guidestar laser update**

Author: Allen Tracy LMCT