AA OPTO-ELECTRONIC and QUANTA TECH propose one of the most complete range of standard Acousto-optic components and associated Radio frequency drivers. AO devices cover wavelengths from 180 nm to 11 μm. The range of RF drivers cover from DC to 3 GHz and up to 500 W. Drivers are matched to AO devices. Custom devices are welcome.

ACOUSTO-OPTIC DEVICES IN QUANTUM COMPUTING... 17.11.2020

Part 1 – AO Modulators and frequency shifters
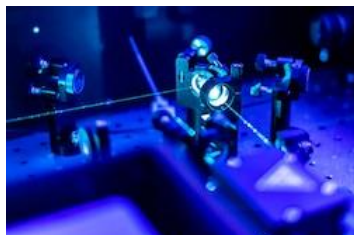
As we all know, modern computers are composed of chips with lots of transistors that act like switches: letting electrons to pass or not, creating a series of '0' and '1' in order to code a particular information. The amount of information to be processed highly depends on the number of transistors, hence showing the limits of such systems.

Quantum computing might be an answer here with the exploitation of the different energy levels in atoms to store or process information. Thanks to the superposition principle [1], a quantum computer operates much faster than a classical one since only one system is required to have multiple bits.

Lasers are involved here to trap the atoms and also as excitation to switch from one energy level to another. In common literature, many wavelengths are involved but the 397 nm seems to be the one used for calcium-43 ions [2].

At AA, we provide numerous models that can operate at such wavelength. The role of the AOM is usually to either stabilize the optical beam's amplitude/fast switching into the traps or to shift its frequency (fixed or variable frequency, positive or negative shift).

TeO2 based AOMs/AOS

Highlights: Fast switching times, Double pass configuration, Large frequency range

Standard Models:

MT80-B30A1,5-400.442: Frequency range 80 +/- 15 MHz, Aperture 1.5 mm

MT110-B50A1,5-400.442: Frequency range 110 +/- 25 MHz, Aperture 1.5 mm

MT250-B100A1-400.442: Frequency range 250 +/- 50 MHz, Aperture 1.5 mm
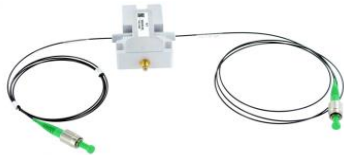
Fused Silica based AOMS

Highlights: Fast switching times, large frequency range, high optical power

Standard Models:

MQ110-B30A3-UV: Frequency range 110 +/- 15 MHz, Aperture 3 mm

MT180-B40A0,25-UV: Frequency range 180 +/- 20 MHz, Aperture 0,2 mm
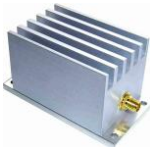
MT240-B80A0,2-UV: Frequency range 250 +/- 50 MHz, Aperture 1.5 mm

These are freespace devices but on request, AA may also provide fiber pigtailed devices.

In order to drive these devices, the Electronic department of AA propose a wide range of standard frequency sources and associated power amplifiers or boosters.

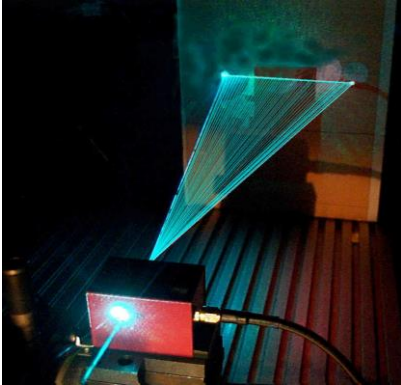AA can also offer a custom product to meet your specifications.

[1] https://arxiv.org/ftp/arxiv/papers/1201/1201.0688.pdf

[2] https://arxiv.org/pdf/1512.04600.pdf

Part 2: AO deflectors (1 axis / 2 axis) in Quantum Computing…

# ACOUSTO-OPTIC DEFLECTORS... 30.11.2020

1 axis and 2 axis

1 axis deflector

An AO Deflector is able to rapidly change the output angle of the laser beam. This angle is directly proportional to the applied RF carrier frequency.

Two deflectors used in crossed configuration allow to get a 2 axis deflexion.

The scan angle of an AOD is proportional to its frequency range divided by the acoustic velocity. For large scan angles, TeO2 in Shear mode will be preferred thanks to its slow acoustic velocity.

In many applications, a high resolution is requested. For this purpose, the laser beam diameter must be as large as possible leading to large crystals. However, a large beam diameter also leads to a slow rise/fall time. As a consequence, a high resolution deflector is also a slow modulator.
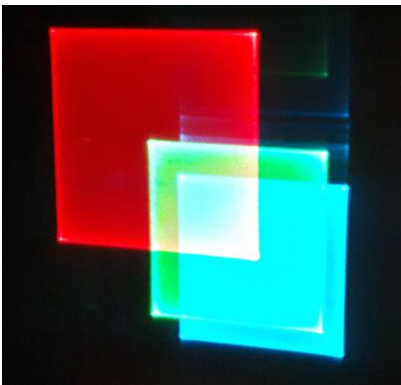

2 axis deflector

1 axis and 2 axis deflectors can be used over a certain wavelength range.

Image on the left shows the projection of an RGB laser using a visible 2D deflector.

Example of applications

Generation of images, (printing, photolithography…), Compensation of the angular errors of the polygonal mirrors, Cavity dumper (the acousto-optical component is placed in the laser cavity and makes it possible to obtain pulsed laser of great energy), Process and defects control for semiconductor applications, Quantum computing using AOD and multitones, Biomediacal applications, multi-photons microscopy...
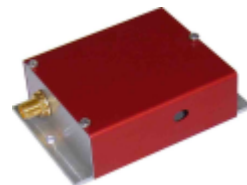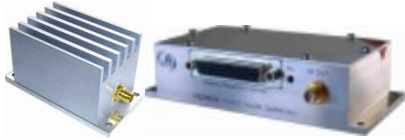
AA proposes the associated drivers for deflectors: power amplifiers, VCOs, DDS, Multi-outputs DDS....