EURIE
EURASIA HIGHER EDUCATION SUMMIT
2017, Istanbul

# Optimising Crop Yield and Agricultural Resources with Precision Laser Sensing

**JOINT RESEARCH AND DEVELOPMENT PROJECT BETWEEN TURKEY & UK**

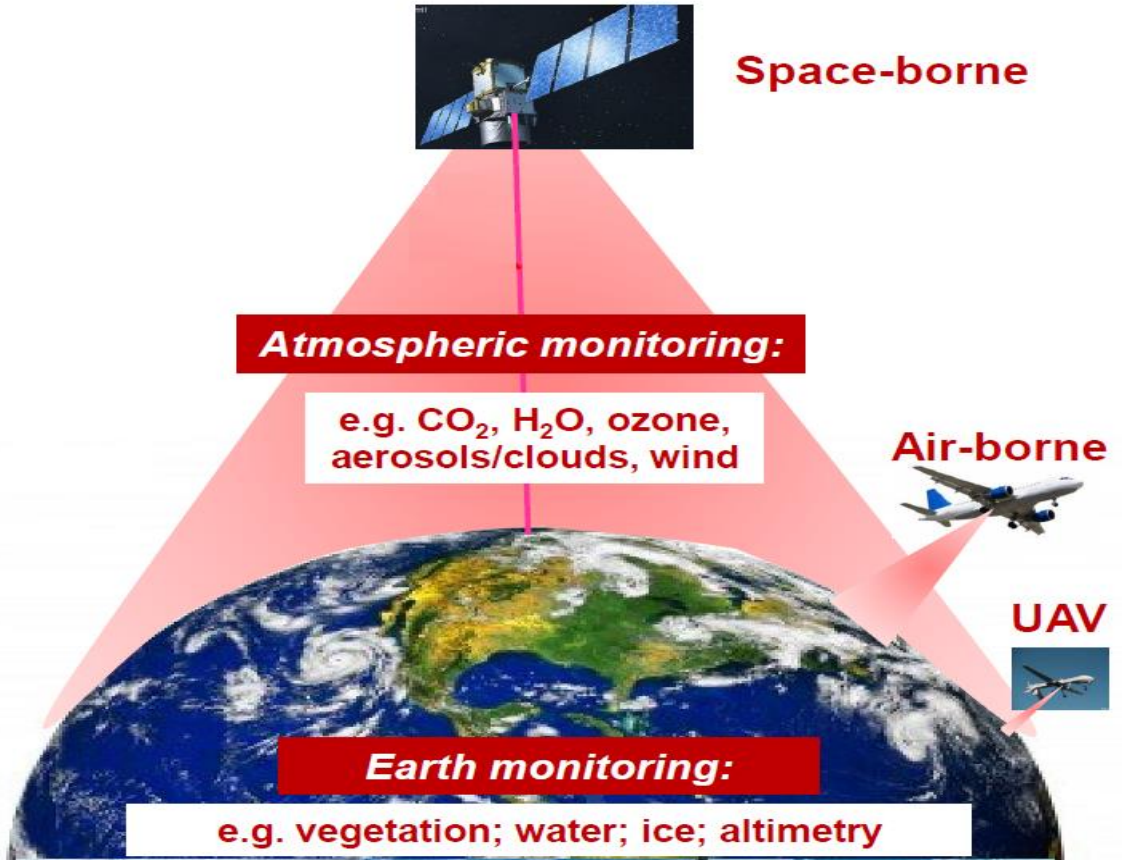

**Turkish Side Co-director: Dr. Ufuk PARALI**
**Adnan Menderes University**

**British Side Co-director: Prof. Michael J. DAMZEN**
**Imperial College London**

# TITLE: Optimising Crop Yield and Agricultural Resources with Precision Laser Sensing

**Laser sources possessing broad emission bandwidths:**

- Wavelength tunable in a wide range
- Different pulse durations (ns/ps/fs)
- Benefit to many technological and scientific studies

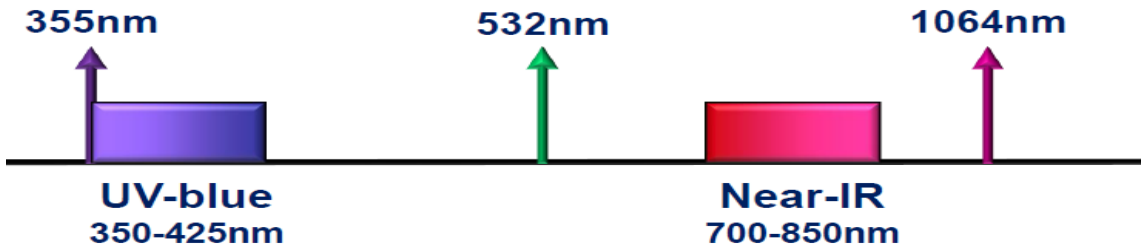


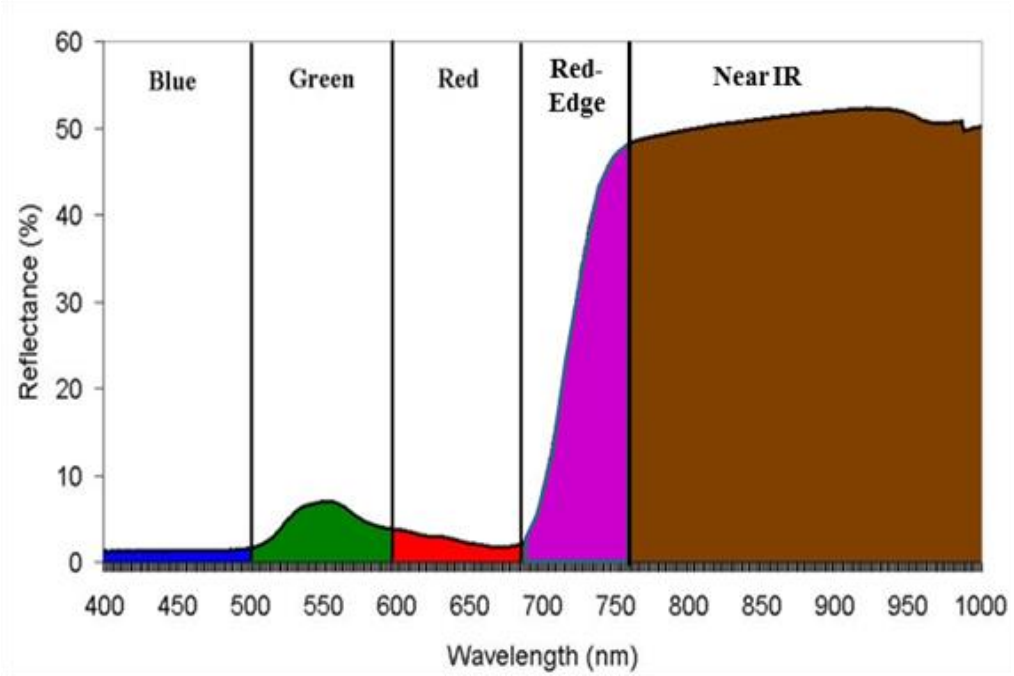

**Space-borne and Air-borne remote sensing:**

- 3-D mapping of atmospheric species and physical attributes
- Spectral indicators of Earth features
- High precision ground topography
- Valuable source for understanding the atmospheric science
- Health of the Earth vegetation and ecological system

# TITLE: Optimising Crop Yield and Agricultural Resources with Precision Laser Sensing

**Cr-doped chrysoberyl (Alexandrite) is an attractive vibronic solid-state laser gain medium with superior optical and thermo-mechanical properties**



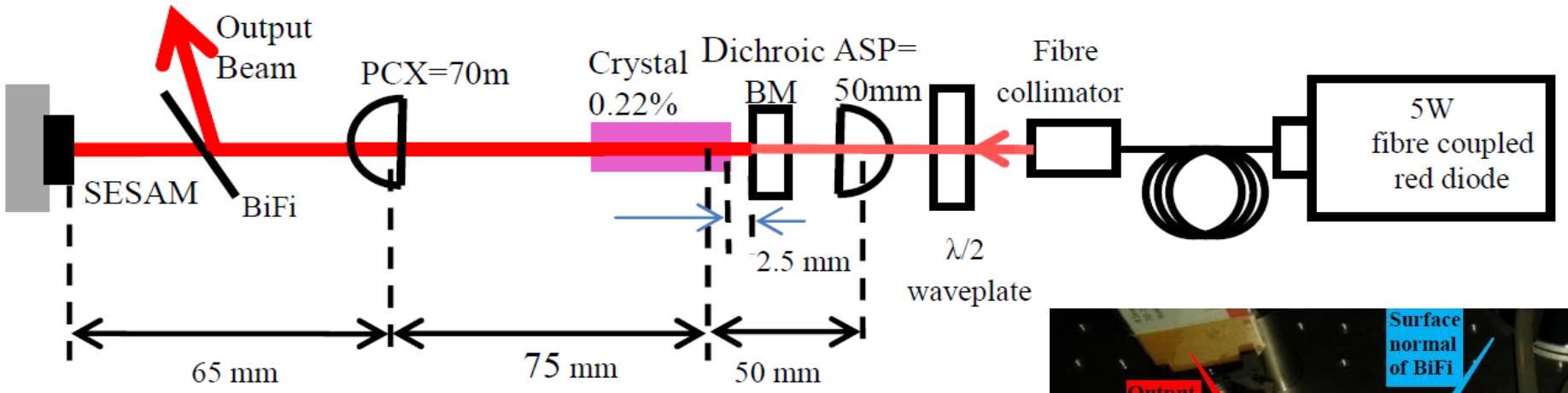

Broad tunability range: ~700 nm – 850 nm

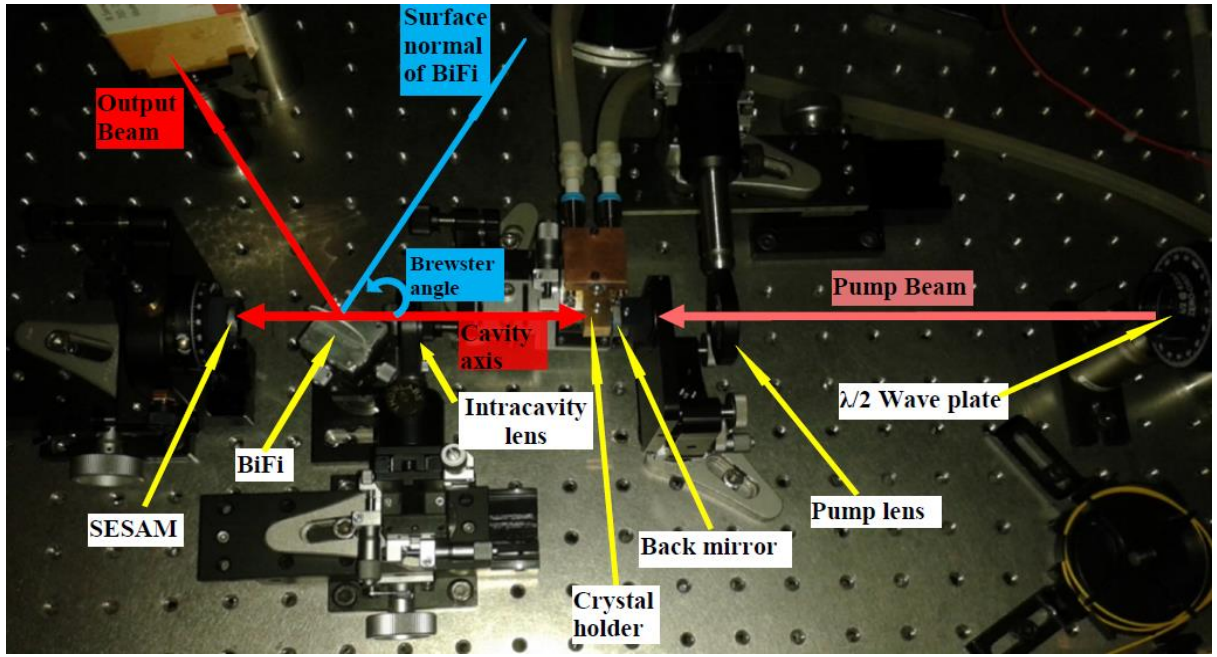
- Relatively higher fracture resistance (x5 Nd:YAG)
- Relatively higher thermal conductivity (23 $Wm^{-1}K^{-1}$) (x2 Nd:YAG and x5 Cr doped colquiriites)
- Relatively longer upper-state lifetime (~260 µs) (Ti:S – 3 µs) at room-temperature (provides a good energy storage potential for Q-switched operation)

- Remote sensing of vegetation: (~700 nm – 750 nm) for chlorophyll
- Changes in this spectral band are well-known as indicators of plant health
- **Very important for a vegetation lidar to cover this red-edge band range**
- Optical parametric conversion: Higher complexity & cost and lower reliability & efficiency

TITLE: Optimising Crop Yield and Agricultural Resources with Precision Laser Sensing

# World-first wavelength tunable passive Q-switched direct diode-pumped Alexandrite laser



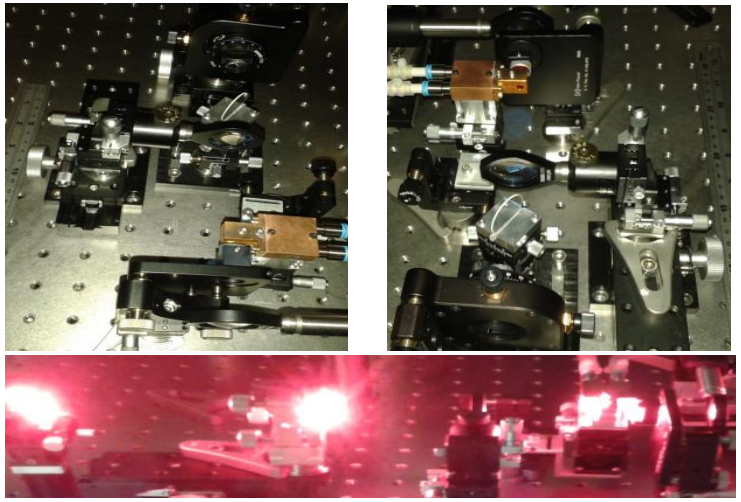


**Ufuk Parali, Gabrielle Thomas, Ara Minassian, Xin Sheng, Michael J. Damzen, "Wavelength tunable passively Q-switched Alexandrite laser with direct diode-pumping at 635 nm ", Proc. of the 5th Int. Conf. on Photonics, Optics and Laser Technology, pages 82-89, ISBN: 978-989-758-223-3, March 2017.**

# Conclusions

- This work demonstrated experimentally the world-first wavelength tunable passive Q-switched (utilizing SESAM) $TEM_{00}$ mode operation of Alexandrite laser with direct red diode-pumping (AlGaInP) at 635 nm.
- Results obtained in this study pave the way for further development, optimization and power scaling of this new generation tunable diode-pumped passive Q-switched (and also potentially for passive mode-locked) Alexandrite laser.
- Potential to become an attractive source for adressing the requirements of many near-future crucial scientific, medical and game-changing industrial applications.
- Attractive source for next generation space-borne/air-borne remote sensing applications, especially for the vegetation lidar systems !!!

Enabling Technology

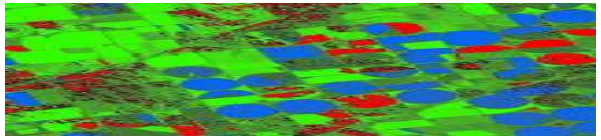


New Opportunities

Space-borne

Air-borne

UAV



# Thank You