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OSCAR: Observation System

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The prototype

Mobile, low-cost, multi-sensors station able to measure the Essential Climate Variables (ECVs)

Sensors	ECVs
Surface meteorological sensors	Temperature, Pressure , Relative Humidity
Rain Gauge	Precipitation
Radiometer (pyranometer)	Solar irradiance at the ground
GPS Antenna receiver	Column water vapor content
Scanning Lidar	Cloud height, fraction, and frequency; profiles of particle optical properties (extinction, backscattering coefficients, LDR)

Surface meteorological sensors

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Vaisala Pressure sensor CS106

Barometer specifications	
Operating range	500 mb to 1100 mb; -40°C to 60°C
Accuracy	±0.3 mb +20°C ±0.6 mb 0°C to +40°C ±1 mb -20°C to +45°C ±1.5 mb -40°C to +60°C
Dimensions	9.7 cm x 6.8 cm x 2.8 cm
Weight	90 g

Rotronic T/RH sensor HC2

T/RH probe specifications	
Operating range	-50°C to +60°C; 0% to 100%
Accuracy	±0.1 °C +23°C ±0.8 % +23°C

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Rain Gauge

Vaisala Rain Gauge RG13H

Heated Rain Gauge RG13H Specifications

Property	Description/Value
Sensor/transducer type	Tipping bucket / reed switch
Accuracy	± 1 %
Sensitivity	0.2 mm
Closure time	< 100 ms (for 0.2 mm of rain)
Capacity	Unlimited
Funnel diameter	225 mm
Orifice (opening area) standard with expander unit	 400 cm^2 1000 cm^2
Max. current rating	500 mA
Breakdown voltage	400 VDC
Capacity open contacts	0.2 pF
Life (operations)	10^8 closures
Heater	38 W / 40 VDC
Thermostat operation	Opens at +11 °C (±3 °C) Closes at +4 °C (±3 °C)
Material	Non-corrosive aluminum alloy LM25
Dimensions	390 (h) × 300 (Ø) mm
Weight	2.5 kg
Temperature range (operating)	-20 ... +85 °C

Radiometer

specifications	
Spectral range	300 to 2800 nm
Operating range	up to 2000 W/m²
Response time	< 12 s
Temperature dependence of sensitivity (-20 ºC to +50 ºC)	<3%

Kipp & Zonen pyranometer SMP3-V

radiant flux, W/m²

GPS Receiver

Novatel GPS Antenna SMART6-L

IPWV (Integrated precipitable Water Vapor [cm]

Lidar for atmospheric profiling

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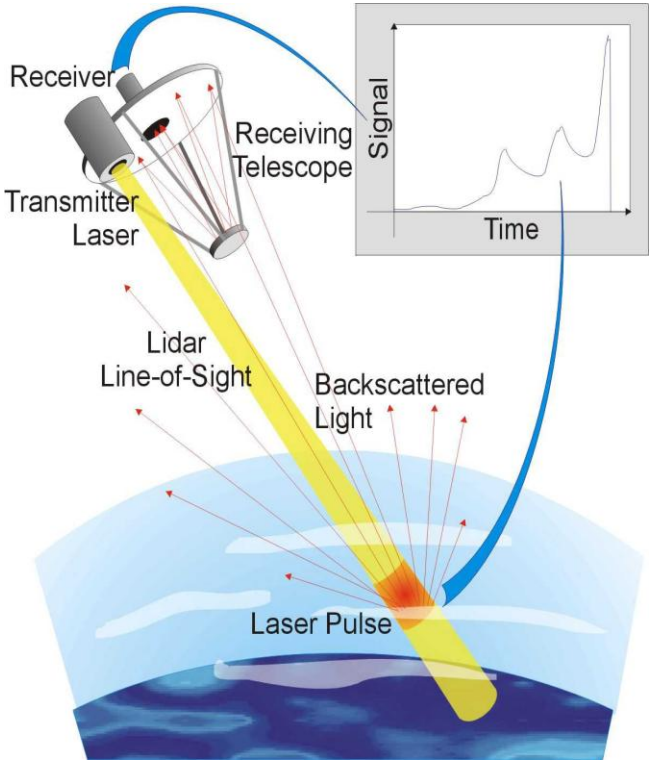
Lidar (**li**ght **d**etection **a**nd **r**anging) is an active remote sensing techniques which allows to obtain the profiles of the properties of atmospheric constituents, (aerosols, clouds, water vapor, ozone, ..) with high spatial and temporal resolution.



The lidar transmits and receives light pulses (λ = 250 ÷ 1100nm)

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OSCAR lidar: transmitter

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Big Sky Laser - CFR 200
Quantel

Transmitter	
Pulsed laser Source	Nd:YAG
Laser Class	IV
Wavelength	532 nm
Energy per Pulse	130 mJ
Repetition Rate	20Hz
Laser Beam Diameter (Near Field)	< 6.35mm
Laser Beam Divergence (Full Angle)	< 4 mrad
Beam Expander	5 X
Beam Divergence	< 0.8 mrad

OSCAR lidar: receiver

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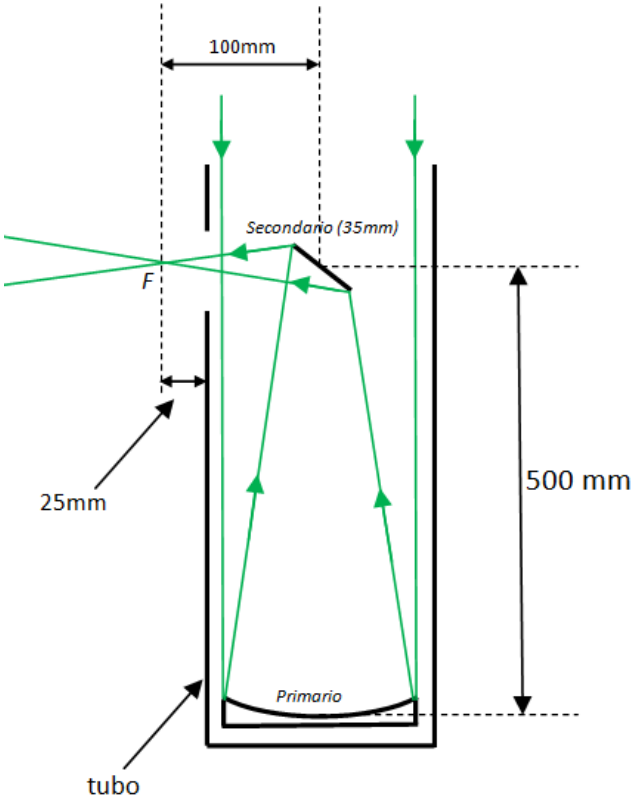
TS UNC1506 telescope



Receiver technical features	
Telescope configuration	Newton
Primary Mirror Diameter	150 mm
Major Axis of Secondary Mirror	49.5 mm
Minor Axis of Secondary Mirror	35 mm
Distance of F from the tube	25 mm
Distance of F from the secondary mirror	100 mm
Focal length	600 mm
F/ Number	F/4
Field of View	2.5 mrad (tunable from 1.5 to 3mrad)
Weight	4 Kg

OSCAR lidar: optical layout

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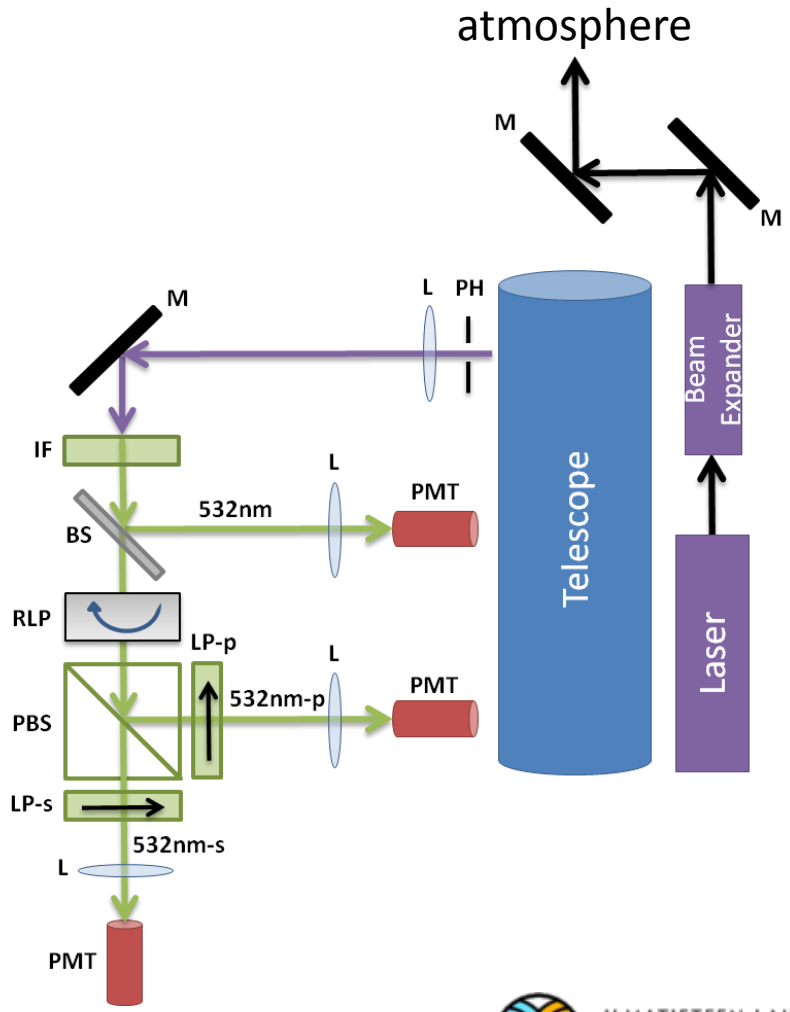
Legend:
M: Mirror
PH: Pin Hole
L: Lens
IF: Interferential Filter
BS: Beam Splitter
RLP: Rotating Linear Polarizer
PBS: Polarizing Beam Splitter
LP-s: Linear polarizer: cross component
LP-p: Linear polarizer: parallel component
PMT: photomultiplier



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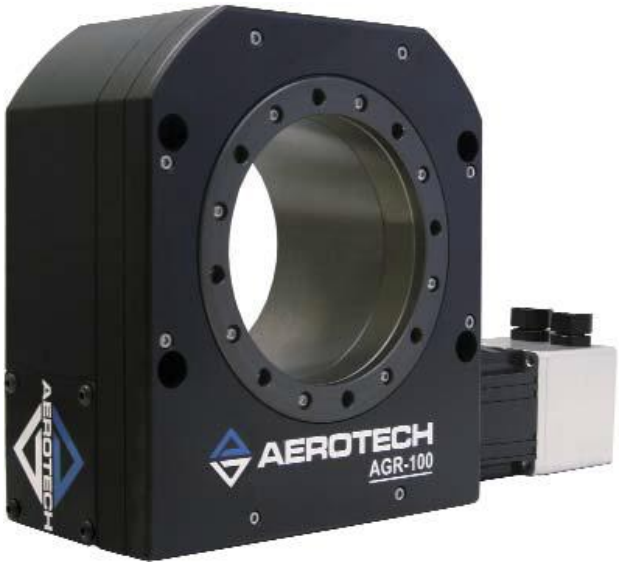
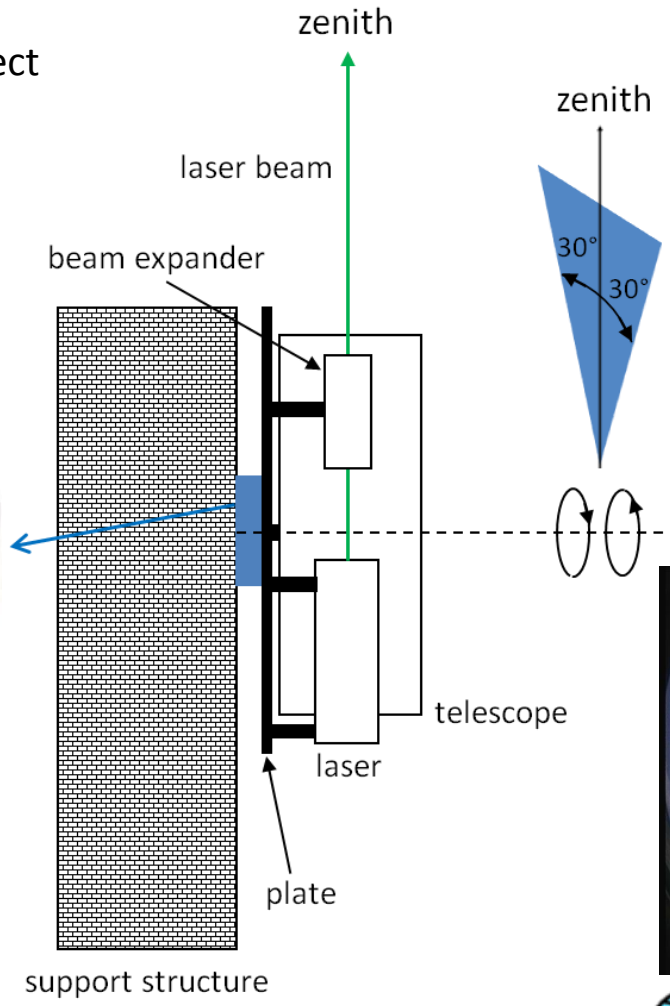
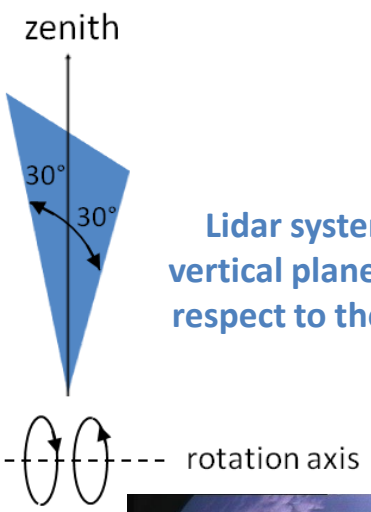
OSCAR lidar: steering unit

rotary stage AGR 100 – BMS with Direct Encoder



Accuracy: 20”= 1/180°
Maximum speed: 180°/s





Lidar system rotating on a vertical plane within ±30° with respect to the zenith direction

OSCAR lidar: products

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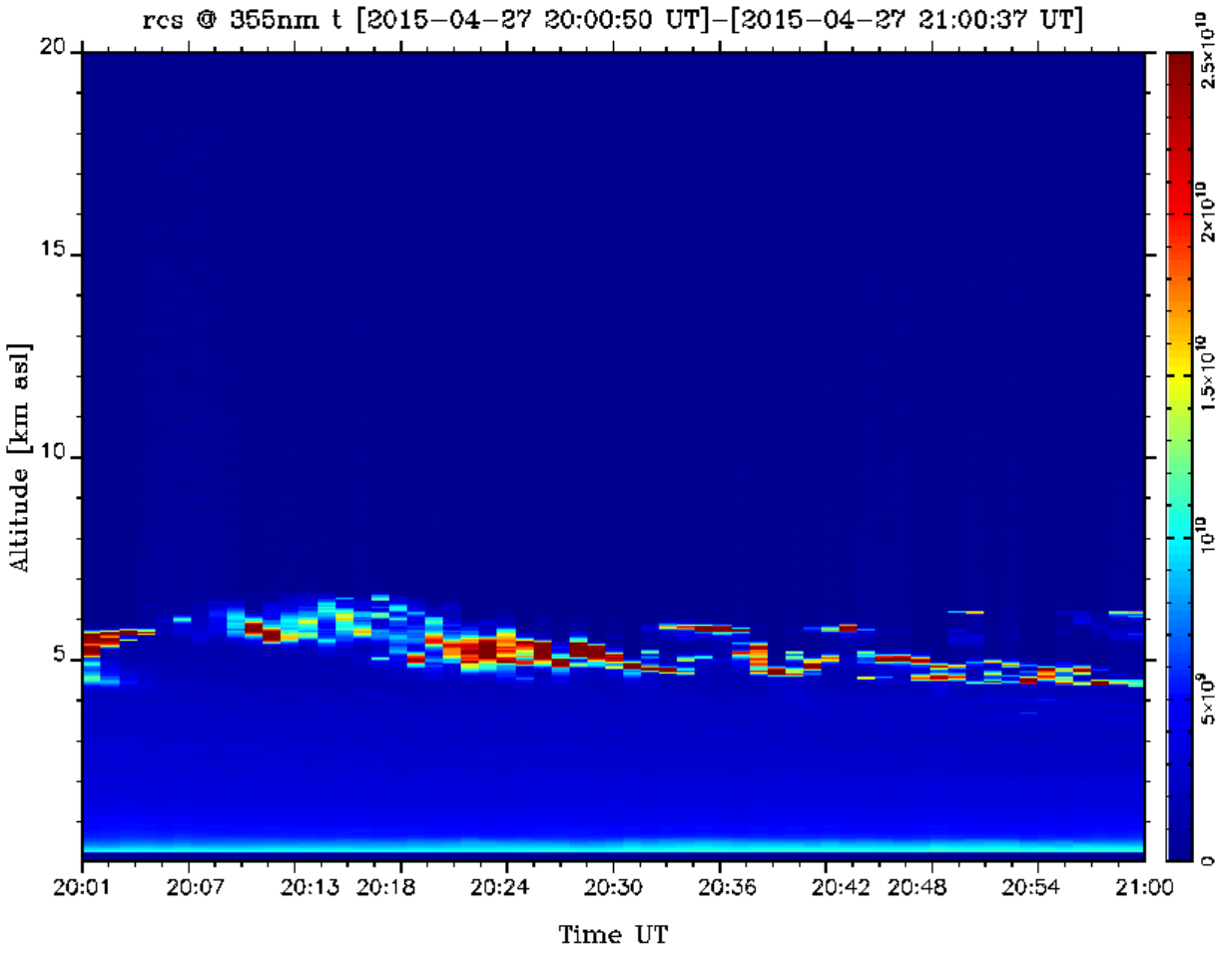

lidar signals:

✓ cloud identification, height, fraction and frequency

✓Profiles of particle backscattering and extinction coefficients

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OSCAR lidar: products

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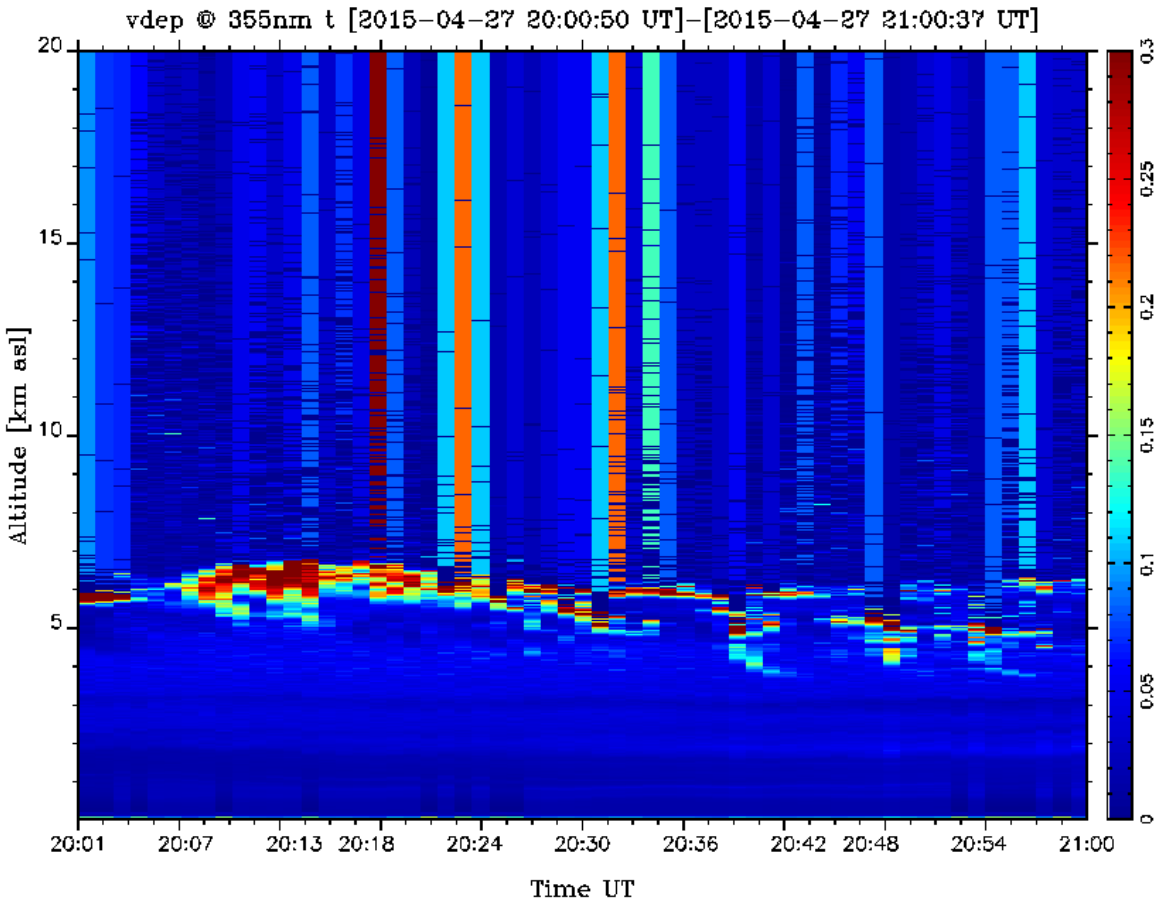

lidar signals:

✓Profiles of linear depolarization ratio (LDR)

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OSCAR lidar: radiative forcing

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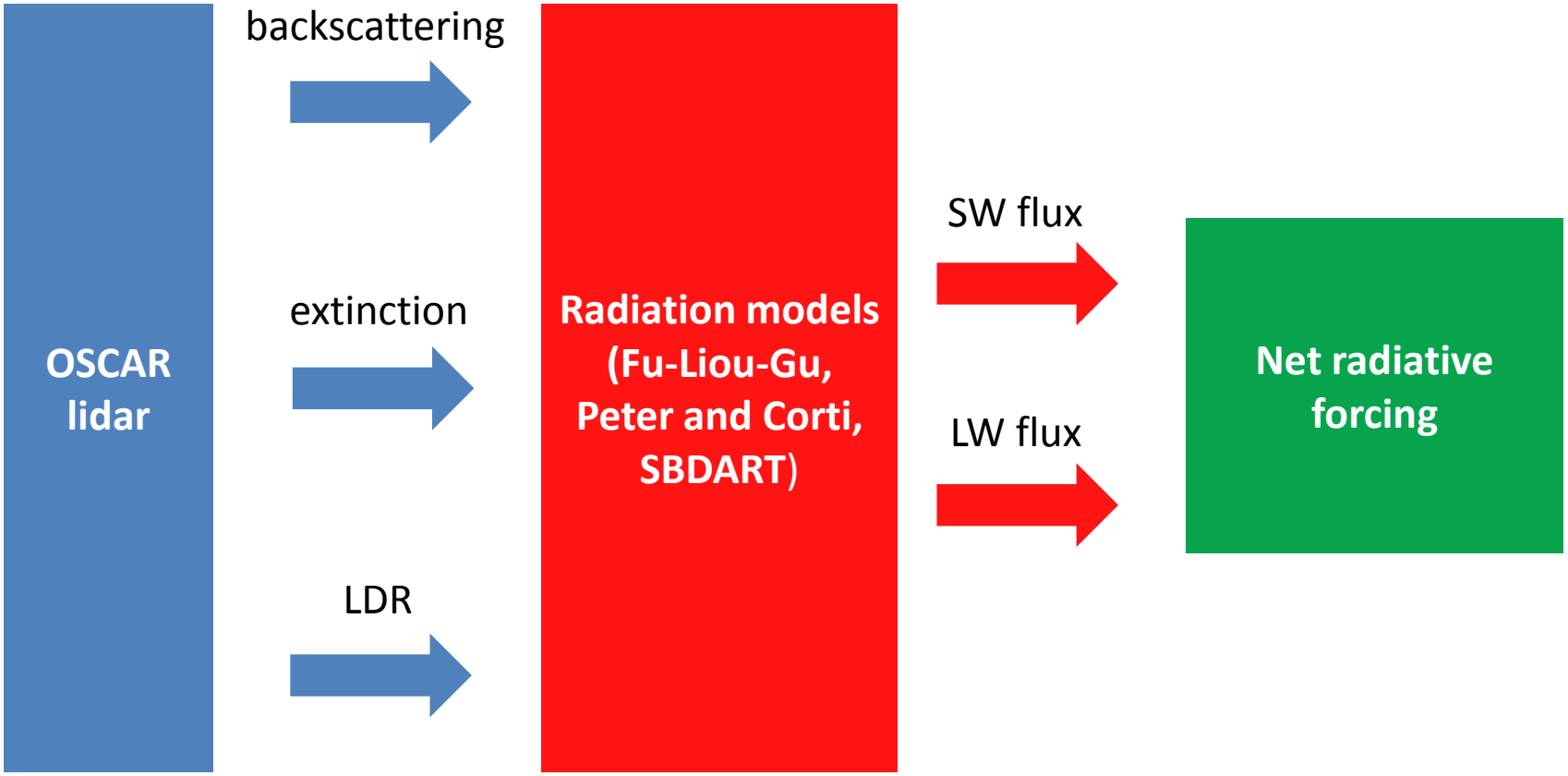

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OSCAR

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