

# Telescope Mounted Computing for Astro Imaging

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“Astrophotography is a serious mental disease”

**Plato (428 - 347 BC)**

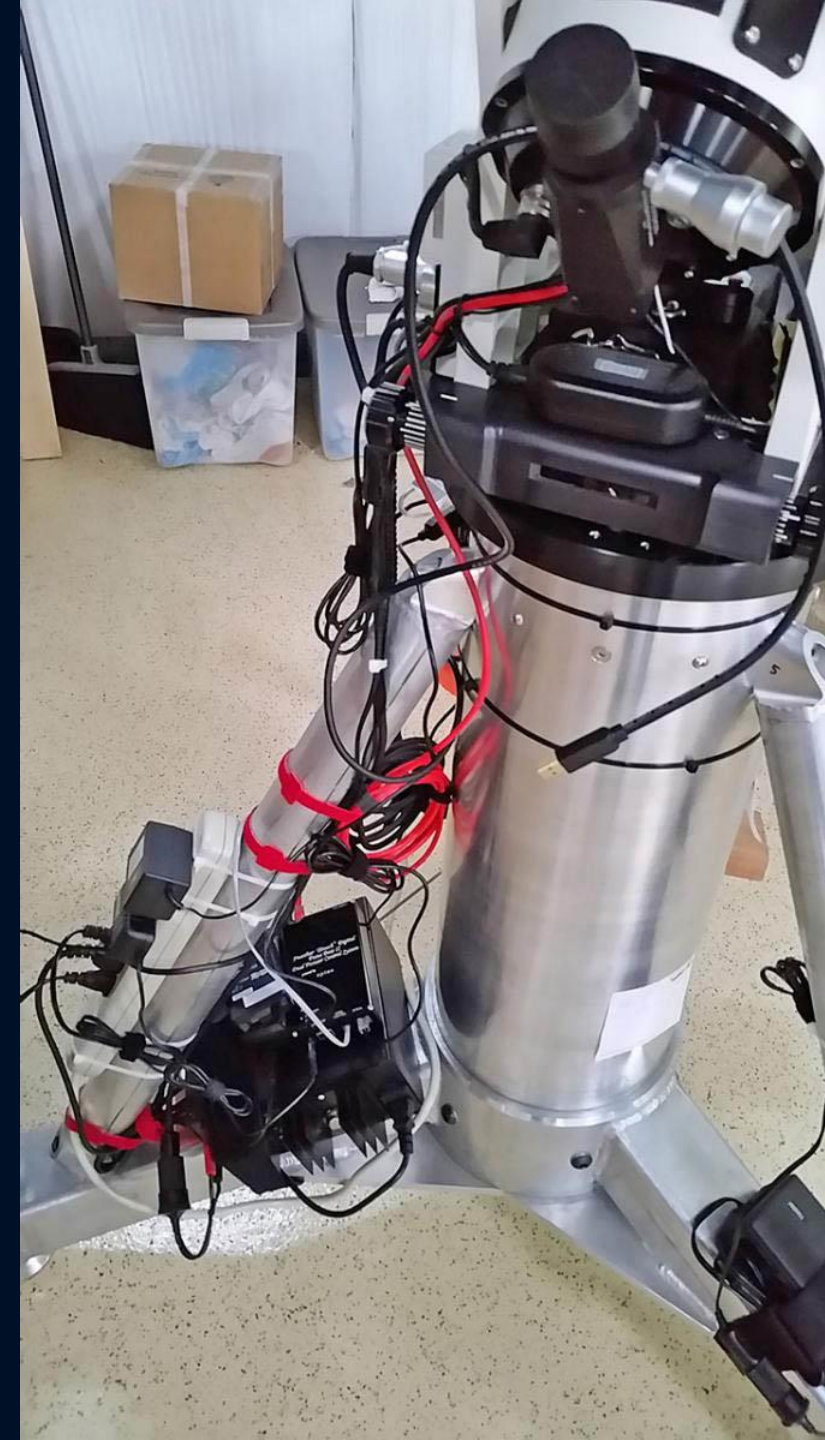
# Telescope Mounted Computing for Astro Imaging

- Why Telescope Mounted Computing ?
- Pro's and Con's
- System 1 – Primalucelabs Eagle 3
- System 2 – ZWO Astronomy ASI AIR
- Alternatives?



# Why Telescope Mount a PC?

- Modern computing has shrunk to a size that **can easily be telescope mounted** with low impact and has reached a consumer price point that is 'affordable'
- **Astro imaging has rapidly developed over the past years** with new cooled CMOS cameras becoming widely available – these invariably need controlled through software and **can require significant amounts of fast data storage**
- A modern astro imaging rig can contain multiple camera USB connections, auto focusers, filter wheel, dew control straps, PC connection to the mount – **cable management is becoming a nightmare!**
- A number of vendors now offer telescope mounted computing that can be easily integrated into an astro imaging rig and these are now starting to become more popular



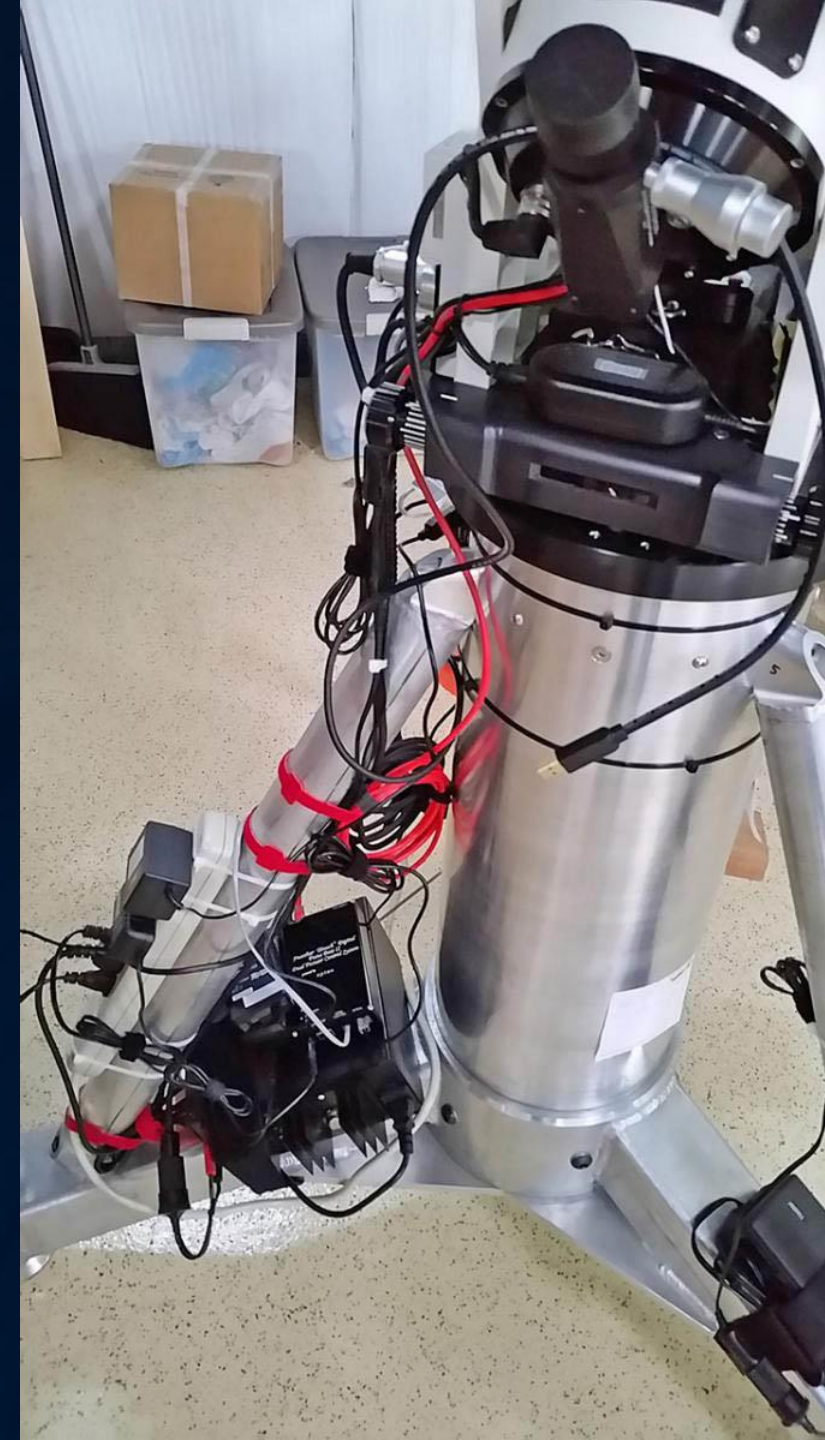
# Pro's and Con's

+

- **Automation** – using programs like Sequence Generator Pro
- **Better cable management**
- **Integrated unit** – quickly able to set up and tear down with less hassle
- **Image capture becomes PC'less** (at least not requiring a permanent connection )
- **Ability to integrate further than a normal PC** – environmental control
- **Remote control** capability

-

- **Can become complex** – you need to be comfortable with technology
- **Cost** (for higher end systems)





# System 1 – Primalucelabs Eagle

## EAGLE3 PRO



MUCH MORE THAN A  
COMPUTER



<b>EAGLE Manager</b> 	<b>Power Bridge</b> 	Windows 10 Ent. 	SSD disk <b>500GB</b>	RAM memory <b>16GB (DDR4)</b>	i5 processor 
USB ports <b>8</b>	Power out ports <b>7</b>	Remote ON / OFF 	Battery status 	WiFi remote control 	To use with 

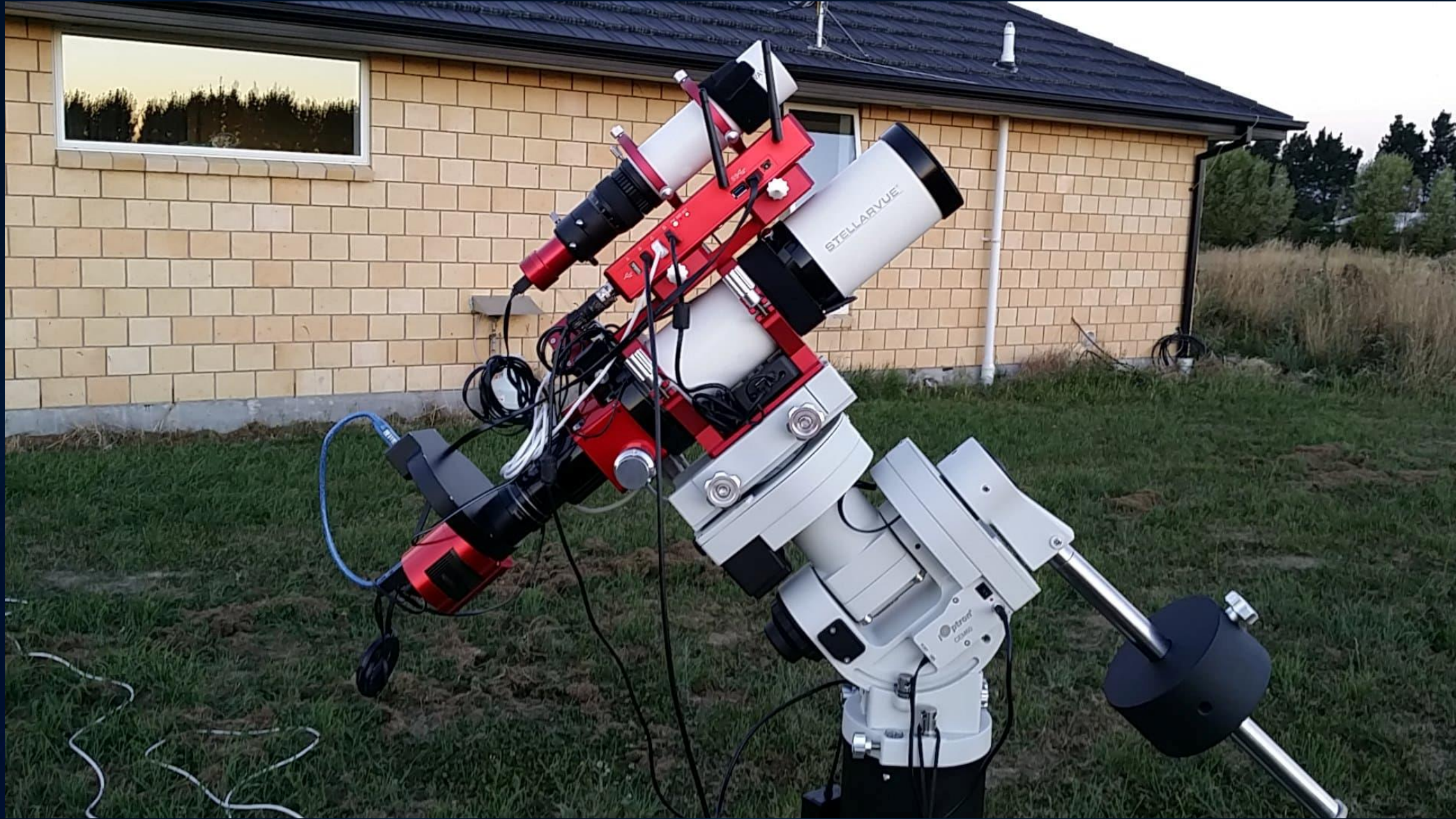
**PLUS**

SCIENCE & INNOVATION  
  
MADE IN ITALY



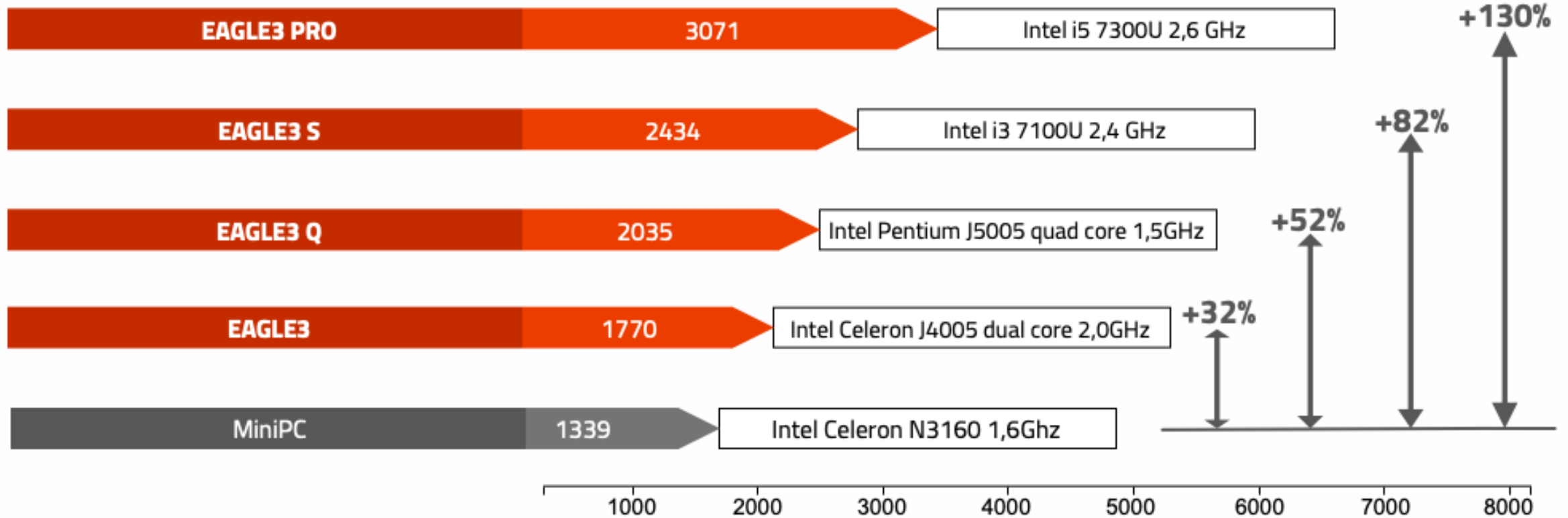


# System 1 – Primalucelabs Eagle





# System 1 – Primalucelabs Eagle



# System 1 – Primalucelabs Eagle

	EAGLE3	EAGLE3 Q	EAGLE3 S	EAGLE3 PRO
Processor:	Intel Celeron 2,0 GHz dual core	Intel Pentium 1,5 GHz quad core	Intel i3-7100U 2,4 GHz dual core	Intel i5-7300U 2,6 GHz dual core, Turbo 3,5 GHz
RAM memory: / SSD disk	4 GB / 120 GB	4 GB / 120 GB	8 GB / 250 GB	16 GB / 500 GB
USB 3.0 + USB 2.0 ports:	8: 4xUSB 3.0 + 4xUSB 2.0	8: 4xUSB 3.0 + 4xUSB 2.0	8: 4xUSB 3.0 + 4xUSB 2.0	8: 4xUSB 3.0 + 4xUSB 2.0
Control via WiFi:	✓	✓	✓	✓
Control via Ethernet:	✓	✓	✓	✓
Remote ON/OFF peripherals:	✓	✓	✓	✓
Remote ON/OFF USB ports:	✓ only for USB 2.0 ports	✓ only for USB 2.0 ports	✓ only for USB 2.0 ports	✓ only for USB 2.0 ports
Power out ports and max current:	7 12V ports , 4x12V + 3x0-12V	7 12V ports , 4x12V + 3x0-12V	7 12V ports , 4x12V + 3x0-12V	7 12V ports , 4x12V + 3x0-12V
Average power consumption:	600 mA/hour	800 mA/hour	1000 mA/hour	1600 mA/hour
Operative system:	Windows 10 Enterprise	Windows 10 Enterprise	Windows 10 Enterprise	Windows 10 Enterprise
Price:	€ 995,00	€ 1125,00	€ 1495,00	€ 1995,00



# Alternatives?

## Power, Capabilities, and Performance in Four Inches Square

### HIGHLIGHTED FEATURES

- 1 Intel Core i3-4010U processor
- 2 Two SO-DIMM sockets for memory expandability up to 16 GB
- 3 Dual PCIe\* mini card connectors for flexible support of wireless and SSD configurations
- 4 One Mini DisplayPort supporting DP 1.2 and one Mini HDMI port, supporting HDMI 1.4a
- 5 Dual rear Panel USB 3.0 ports
- 6 Intel® Gigabit LAN
- 7 19V, 65 W DC power connector
- 8 Dual front panel USB 3.0 ports
- 9 Consumer infrared sensor
- 10 Headphone/microphone jack



Intel NUC PC

compwarehouse



Stick PC



Pegagus Astro Powerbox

# System 2 – ZWO Astronomy ASI AIR

- Raspberry PI based imaging system designed as a **low cost but rich feature imaging platform** for astro imaging
- Uses **Android / IOS** tablets as the control panel
- Lightweight, scope mounted unit **providing remote control capability**
- **Low power requirements** – great for portable imaging
- **Low cost** – but powerful imaging platform
- **Easy to use** and requires little technical expertise to use
- Does **not** need the tablet connected all the time
- Evolving development – **lots of new features being added** – free at this time.
- **Whats coming:** Auto focus .... Polar Alignment ..... Much more!

**ASi air**

Astrophotography has never been easier

ASI camera on  
**Portable** Telescope Mount

ASI camera on  
Computerized **GoTo** Telescope Mount



- ✓ standalone guider for DSLR user
- ✓ Full ASI USB3.0 camera control
- ✓ lightweight and portable setup for wide field astrophotography
- ✓ plate solving and Sync the mount
- ✓ SkySafari bridge and full mount control





# System 2 – ASI AIR

- Simple low cost Android / IOS tablet as control panel – **NO PC**
- **Camera control, cooler control, filter wheel control** – for cooled and non cooled ZWO cameras – NOW SUPPORTS Nikon /Canon DSLRs (V1.0.9)
- **Integrated auto guider** – easy to use – looks like PHD2
- **Mount control** for many well known brands (INIDI supported) – got to / dithering
- **Fast plate solving** – seconds to solve – sync to mount
- **Integrated sequencer** and target acquisition tools
- **Integrates to Sky Safari** for tablet mount control
- Built in **32GB SD card** - 5V USB powered
- **Low cost** - \$179 USD



# System 2 – ASIAIR

The screenshot shows the ASIAIR control interface with several key areas highlighted by red boxes and labels:

- Setup Area:** Located at the top, containing icons for WiFi, Main camera, Guide camera, Mount, Filter wheel, SD card, and More settings.
- Function Area:** Located on the left side, containing icons for Histogram, Debayer, Guide, and Plate Solve.
- Information Area:** Located at the bottom, displaying system status such as Resolution (4144x2822), Gain (200), Temperature (TEMP:-10.00°C), Cooler (90%), and Status (Idle).
- Main Function Switch:** A red dot on the right side, used for Focus, Preview, and AutoRun.
- Operation Area:** A red box on the right side containing a play button for Capture, Preview, Bin, Exposure, and Save.
- Mount Controller:** A red box on the right side containing a directional pad and a 2x magnification button.

The central display shows a star field with a histogram overlay and a table of RMS Error data:

RA	DEC
1.21"	0.62"
Tot	1.32"

Additional data shown in the interface includes a histogram at the bottom left, a play button labeled 'BIN1', an exposure time of '120s', and a table of image statistics:

Information	
Max	65532
Min	3180
Ave	5369
Std	1831



# System 2 – ASI AIR

The screenshot displays the ASI AIR software interface, which is divided into several key functional areas:

- Setup Area:** Located at the top, it contains icons for WiFi, Main camera, Guide camera, Mount, Filter wheel, SD card, and More settings.
- Home:** A home icon is located in the top left corner.
- Function Area:** A button with a graph icon is used to show or hide the guiding graph.
- Guiding Graph:** A graph showing the coordinate system and data, with controls for y: +/-4", x: 50, and a Clear button.
- Operation Area:** A vertical sidebar on the right containing icons for information, refresh, calibration (crosshair), stop, and exposure (EXP).
- Information Area:** A status bar at the bottom displaying resolution (1280x960), Gain (48), FPS (1.15), Star coordinate (1000,211), and Status (Guiding).

Additional details visible in the interface include a peak graph in the top left with values: Peak 62, FWHM 2.68. The bottom right corner shows RA and DEC error statistics: RMS Error, RA 0.42", DEC 0.31", and Tot 0.43".

# System 2 – ASIAIR

1/100

Autorun

299s

Guiding

Information

Max	65504
Min	80
Ave	1016
Std	471

Shooting

4656x3520 Gain: 139 TEMP:-20.00°C Cooler: 6%

Peak 42  
FWHD 3.96

Graph

1304x976 Gain: 134 FPS:0.28

### Guide Settings

West step 4, dist= 8.0

DEC Guide Mode  Off  Auto  North  South

DEC Aggressiveness  100%

Gain 134

0  600

Dither Settings >

Advanced Settings >

1304x976 Gain: 134 FPS:0.28

### Telescope Settings

Telescope SkyWatcher SynScan

Serial /dev/ttyUSB0 Baud Rate: 9600

Location Lat: +44°37'13" Long: -73°39'42"

Current RA: 17h 6m 32s DEC: +88°54'28"

Target RA: 17h 6m 32s DEC: +88°54'28"

Date: 2018-12-12 Time: 17:46:54

4656x3520 Gain: 139 TEMP:-20.00°C

### Dither Settings

Dither

Distance(px)

\*Defines how big to be moved with random direction on Guider.

Stability

Settle Time

\*Defines how long to wait for guiding to be stable after dithering.

1304x976 Gain: 134 FPS:0







# Alternatives?



Get  
Stellar Mate  
Now



 Capture	 AutoFocus	 AutoGuide	 Astrometry	 Scheduler
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An advertisement for the Stellar Mate camera module. The background is a dark space scene with a galaxy. The text "Get Stellar Mate Now" is prominently displayed in orange and white. A smaller version of the Stellar Mate camera module is shown in the upper right corner. Below the text is a row of five orange buttons, each with a white icon and a label: "Capture" (camera icon), "AutoFocus" (magnifying glass icon), "AutoGuide" (target icon), "Astrometry" (target icon), and "Scheduler" (rocket icon).



# Further Reading / Resources

<http://primalucelab.com>

Primalucelabs Eagle 3

<https://astronomy-imaging-camera.com/>

ZWO Cameras and ASIAIR

<https://www.facebook.com/groups/ASIAIR/>

Questions?