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REDUCING NOISE IN HIGH ISO IMAGES

With Theory…

… and a Test!

Reducing Noise in High ISO Images

- **What is Noise?**
  - Why is it worse in high ISO images?
- **How can you reduce it:**
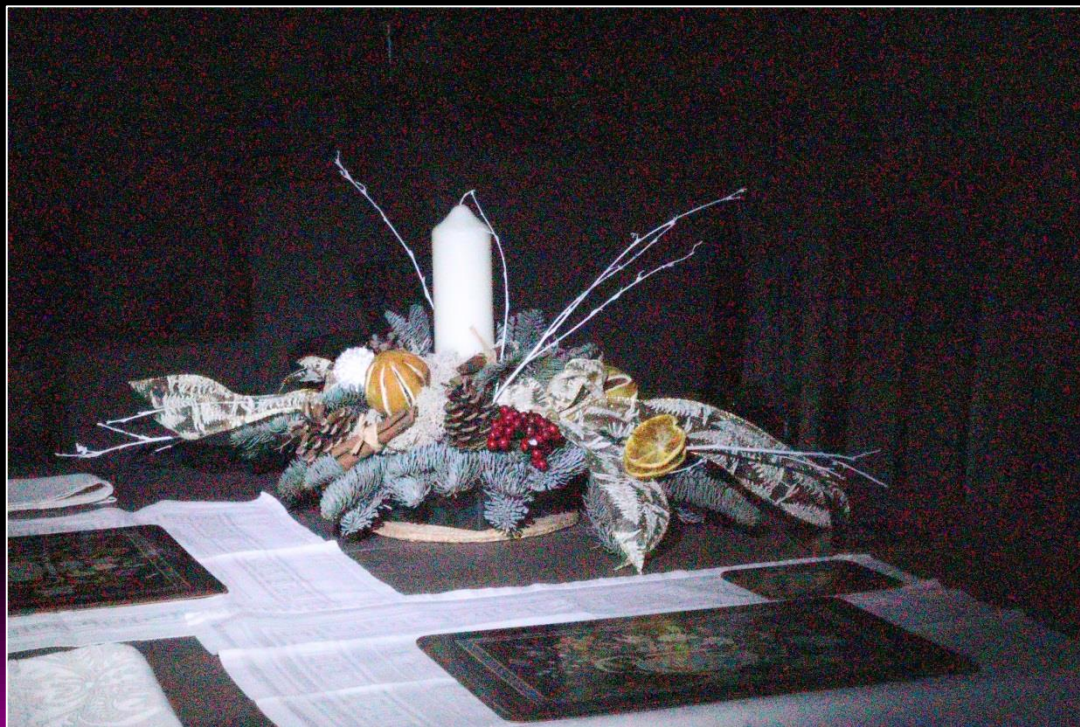 - Post-processing
  - In Camera

What is Noise?

- Individual pixels in an image that are not representing the colour, or the exposure of the scene correctly.
  - Incorrect colour representation is called Chroma Noise.
  - Incorrect exposure representation is called Luminance Noise.

Noise example

Types of Noise – Random Noise

- Also called Shot Noise or Gaussian Noise
- Light consists of discrete particles (photons)
- Image sensor has an array of "buckets"
- Number of photons captured in each bucket varies randomly (Quantum Fluctuation)
- In brightly lit scenes the random fluctuation is not noticeable.
- In low light situations they can be significant.

Types of Noise – Random Noise

- 1. Bright even light equivalent to 100 photons per bucket per second
  - Quantum fluctuation is ± 5 / bucket
  - Buckets contain between 95 and 105 photons
  - Imperceptible variation in the sensor signal
- 2. Low even light equivalent to 5 photons per bucket per second
  - Quantum fluctuation is still ± 5 / bucket
  - Buckets contain between zero and 10 photons
  - Raising the ISO sensitivity by 20x produces a average signal equivalent to 100 photons per bucket
  - Signal varies from zero to 200 with a Gaussian distribution
  - Extremes are perceived as Noise
  - The pattern will be different for every exposure even if the conditions are identical.

Types of Noise — Fixed Pattern Noise

- Also called "Salt and Pepper" Noise or "Hot Pixel" Noise
- Appears in long exposures
- Caused mainly by sensor heating
- Same exposure conditions (ISO, time, temperature) will produce the same pattern of noise.
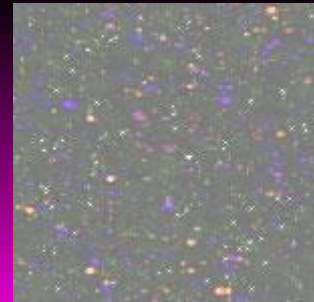
Types of Noise – Read Noise

- Also called Anisotropic Noise or Periodic Noise
- Introduced by the camera when reading from the sensor.
- Caused mainly by internal electrical interference
- Less of a problem with modern sensors/processors.

Reducing Noise — Post Processing Demos

- LightRoom/PhotoShop Noise Slider
- PhotoShop Stack
- PhotoShop Smart Object

Examples of Post Processing NR

Stephen Jones ISO:65,535|1/60|f7.1
5 exposures PhotoShop Stack Smart Object | Mode=Median
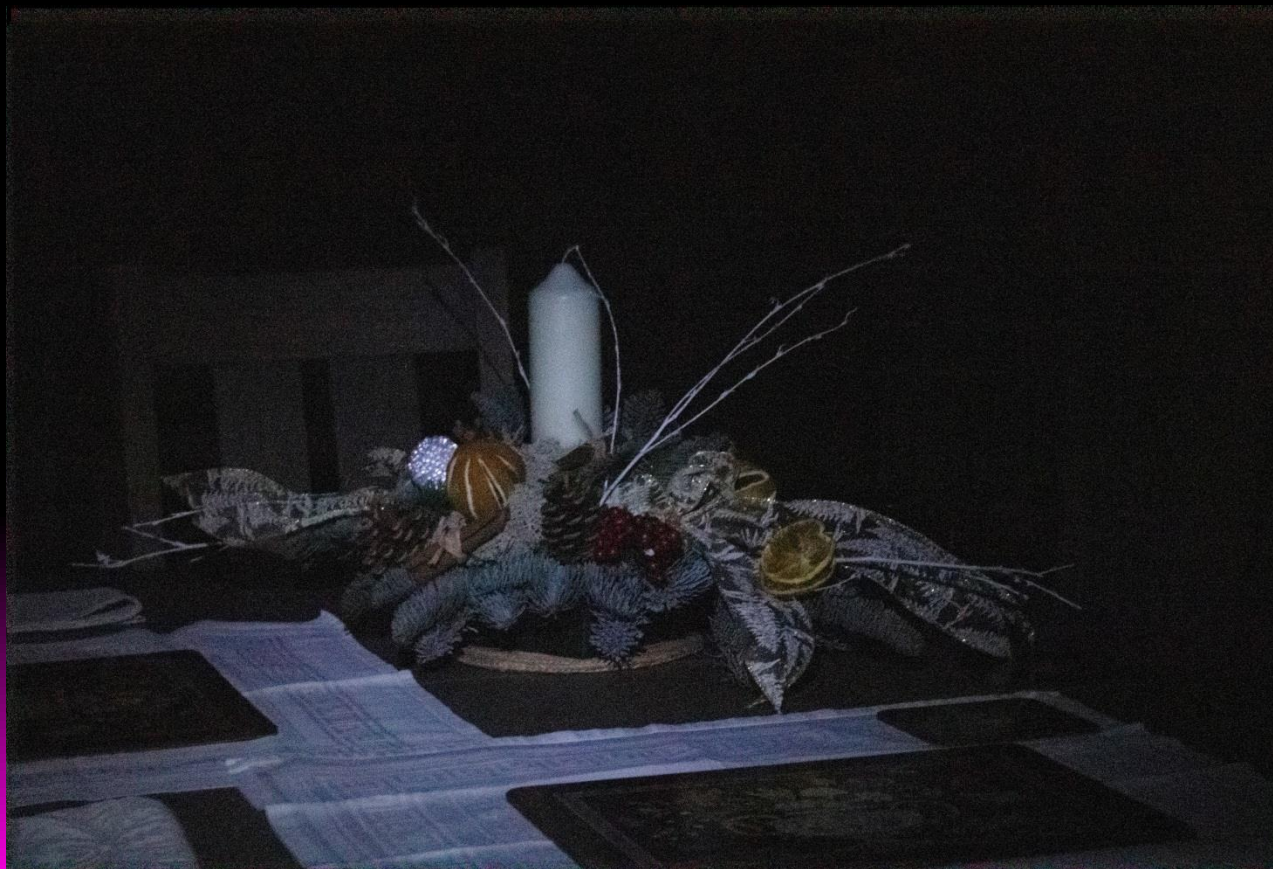
Tony Leonard ISO:102000
5 exposures PhotoShop Stack Smart Object | Mode=Median

NLD Table Arrangement ISO:52,000|1.3|f18
4 exposures PhotoShop Stack Smart Object | Mode=Mean/Median

Stephen Jones St Olaf ISO:65,535|
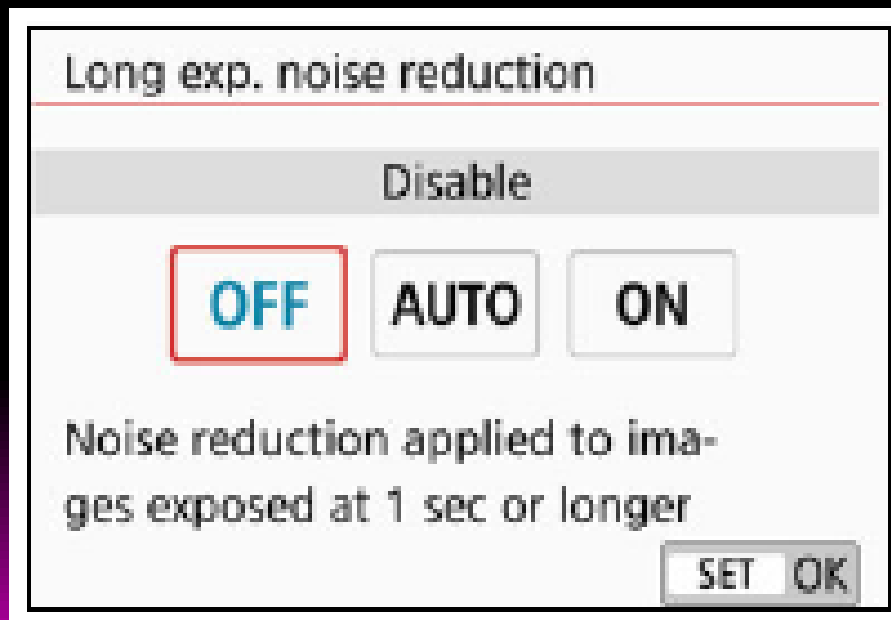5 exposures PhotoShop Stack Smart Object | Mode=Mean

Reducing Noise – In Camera

- Some automatic Noise Reduction applied to JPG images
- Long Exposure Noise Reduction
- High ISO Noise Reduction
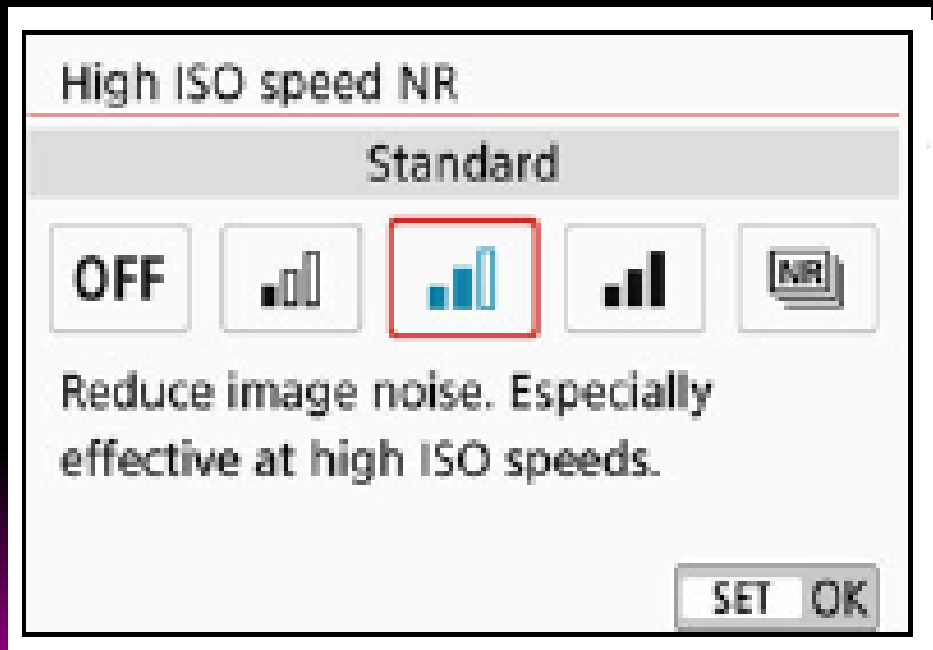
In Camera Noise Reduction – Canon 800D

In Camera Long Exposure Noise Reduction

- "Long" exposure camera dependent (Canon > 1 second)
- Camera takes a "black screen" exposure with same shutter speed
- Digital processor subtracts any noise in black screen from the original image
- Very good for dealing with Fixed Pattern noise
- Effectively doubles the time to take each image
- Can take your own black screen exposure and subtract in post processing

In Camera Noise Reduction – Canon 800D

In Camera — High ISO Noise Reduction

- Canon options: Off, Low, Standard, High, Multi-shot
- Low, Standard, High apply a pixel smoothing algorithm
- Very similar to LR/PS Noise Slider
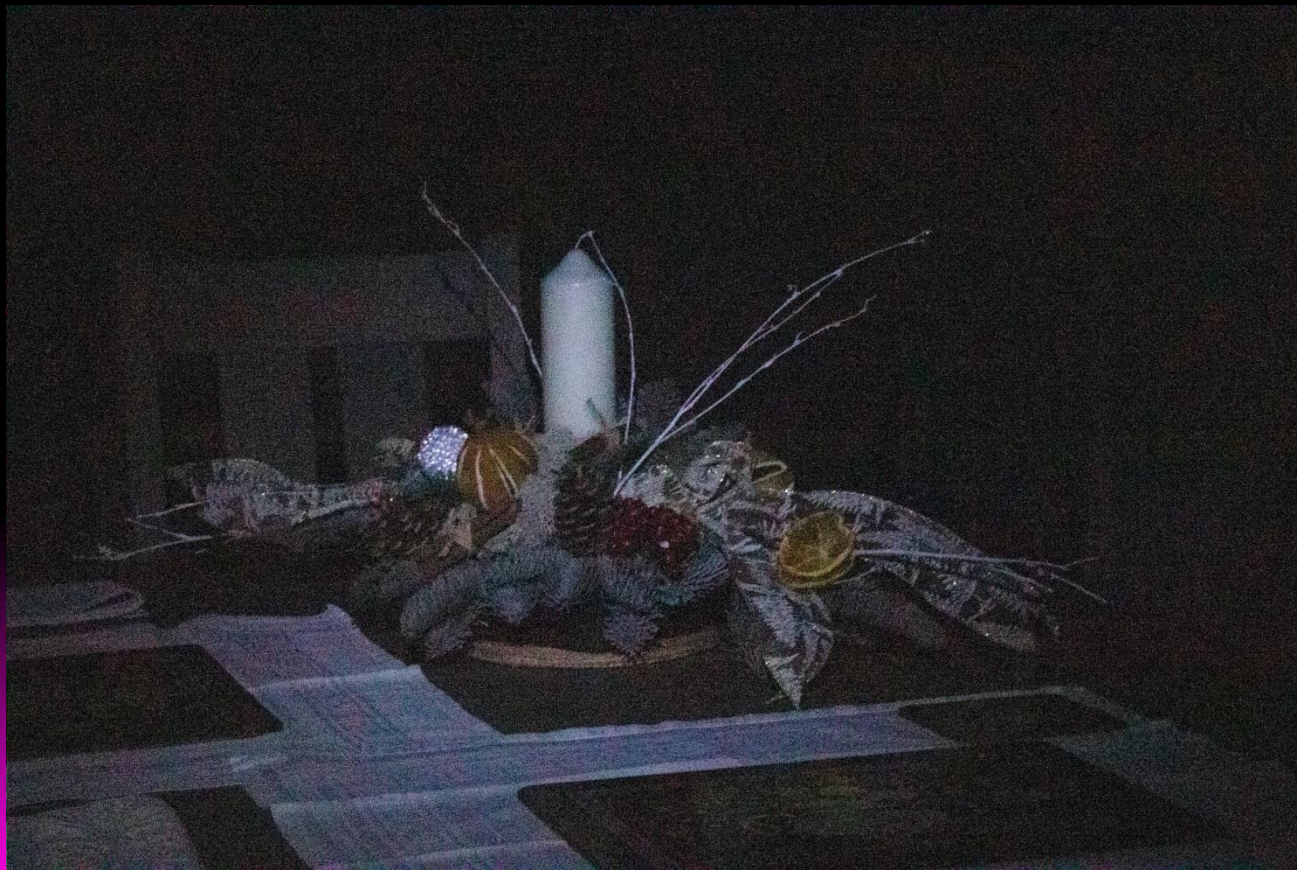
In Camera – Multi Shot Noise Reduction

- Camera takes a burst of multiple (Canon = 4) exposures.
- These are auto-aligned, combined and averaged.
- Very similar to my post-processing technique but with less user control.
- Can work very well as long as no subject movement .
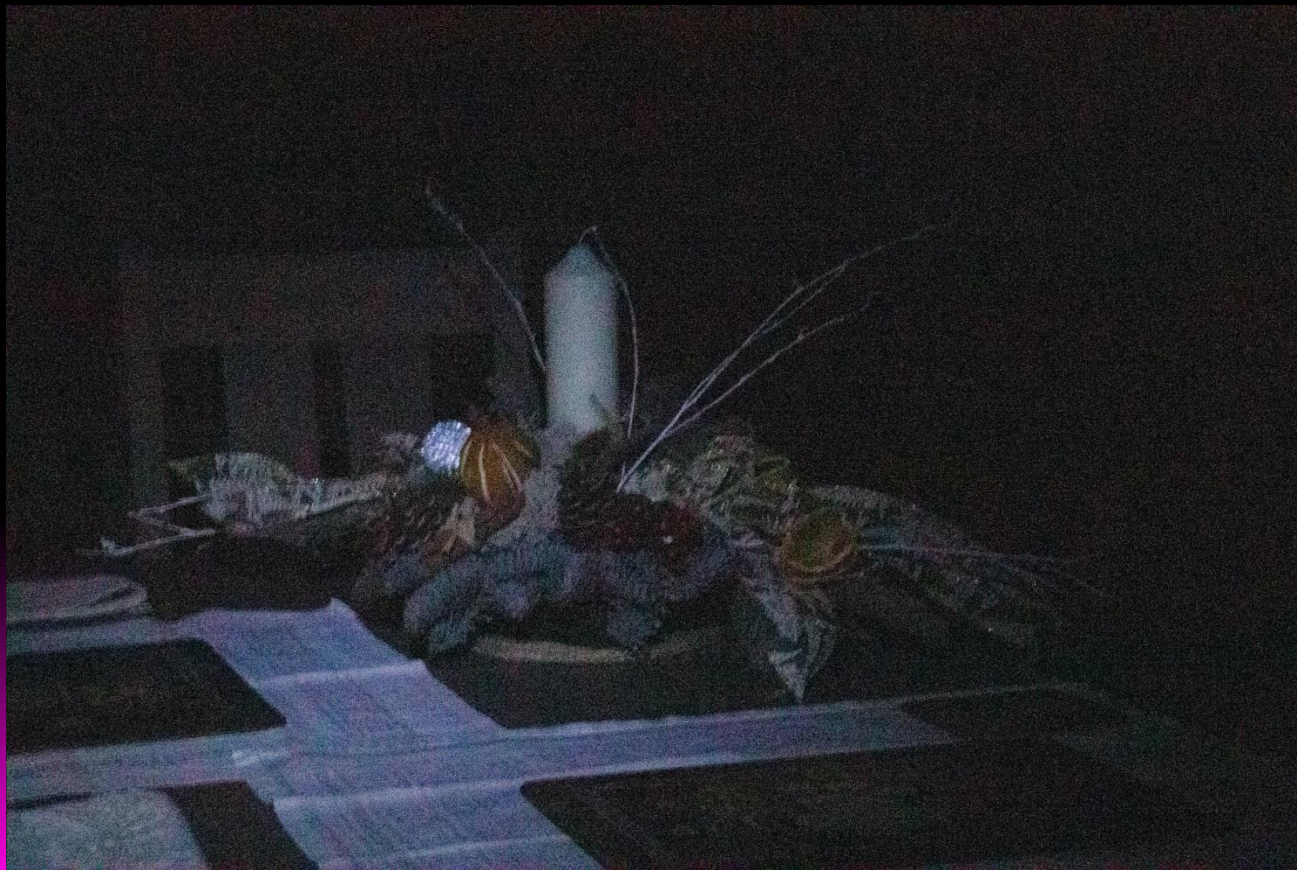- Cannot be used with RAW image capture

Examples of In Camera NR

NLD Table ArrangementISO:51,200|1.3sec|f18
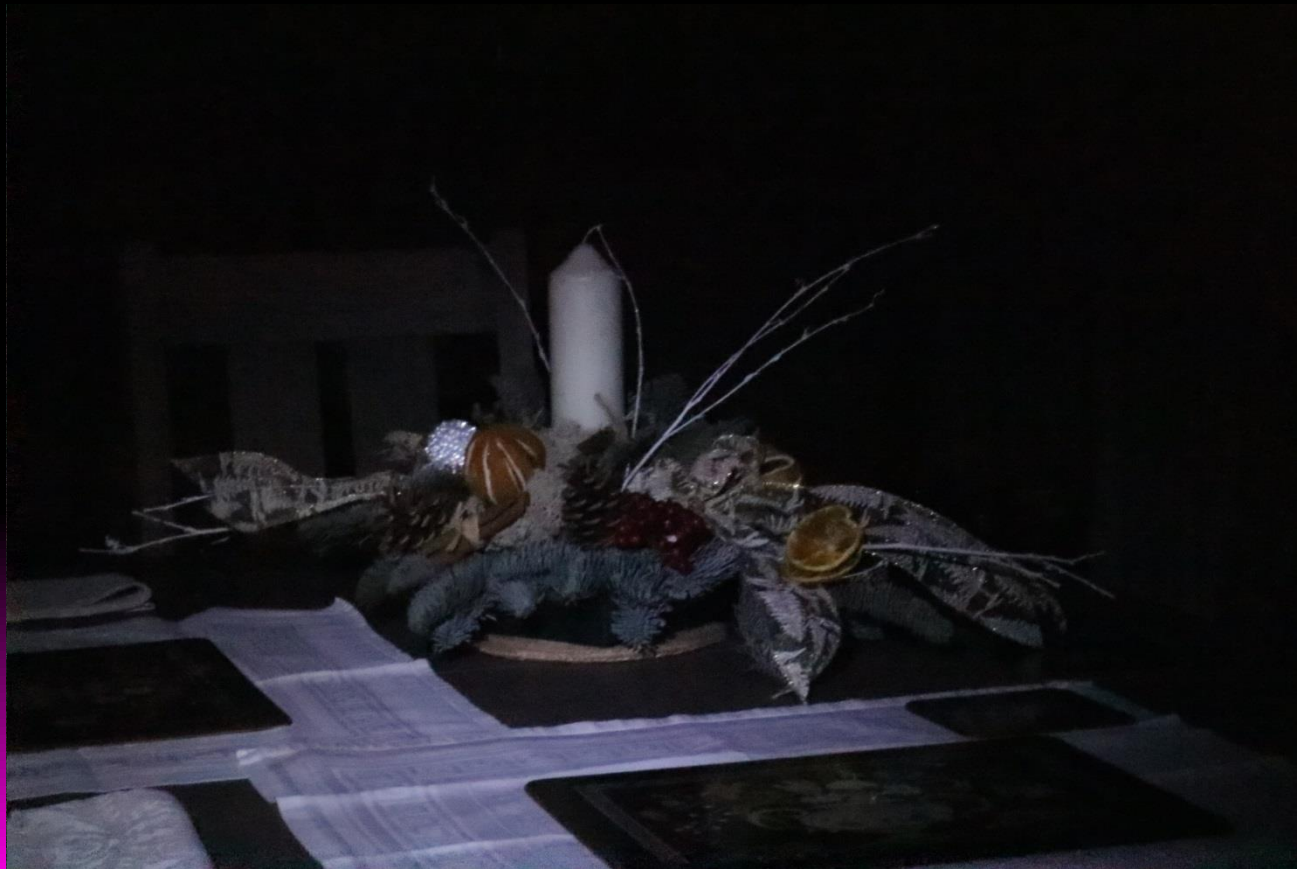In Camera Long Exposure Noise Reduction

NLD Table Arrangement ISO:51,200|1/25|f4.5
In Camera High ISO Noise Reduction | Strong

NLD Table Arrangement ISO:51,200|1.3sec|f18
In Camera Multi-Exposure Noise Reduction

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with thanks to
Stephen Jones
Tony Leonard

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