Measuring Backyard Light Pollution

By: Jim Thompson

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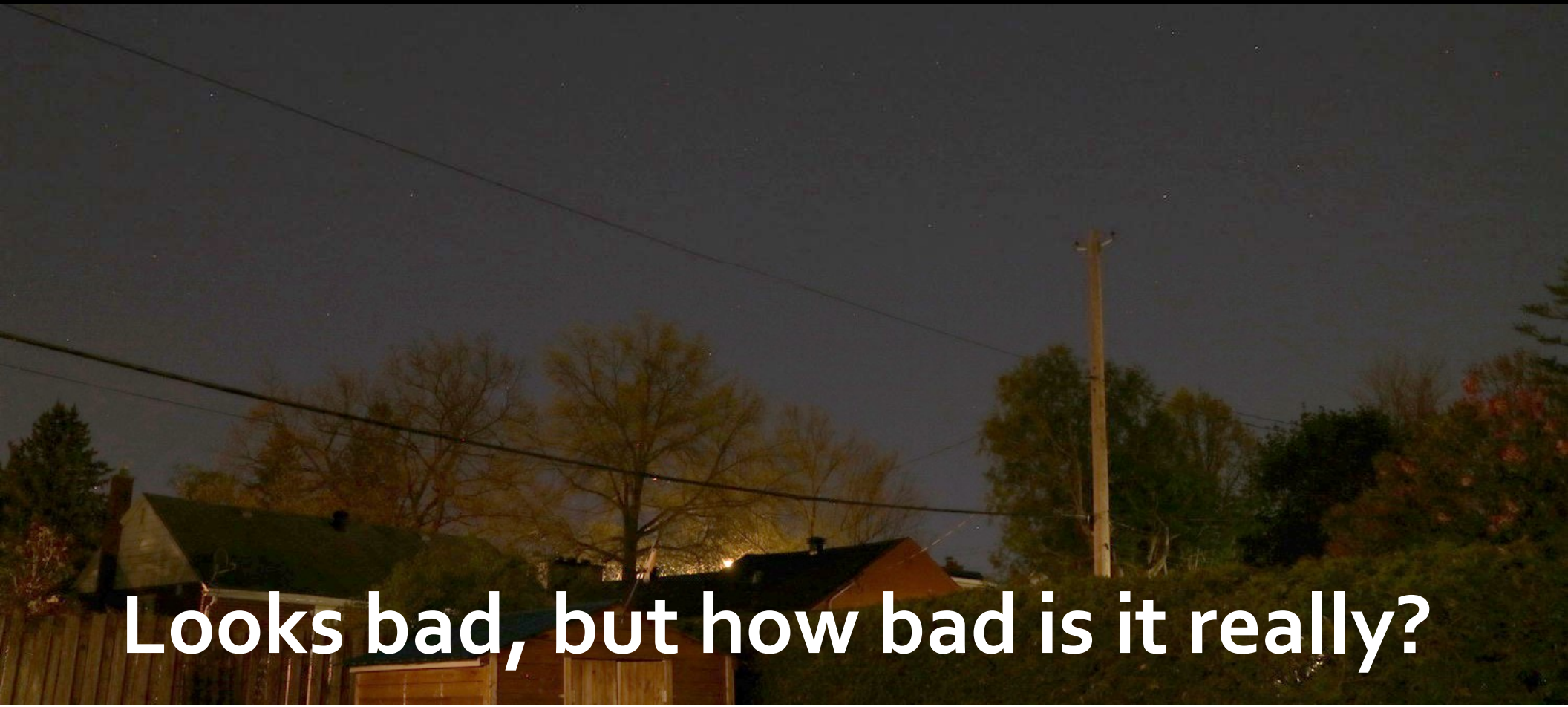
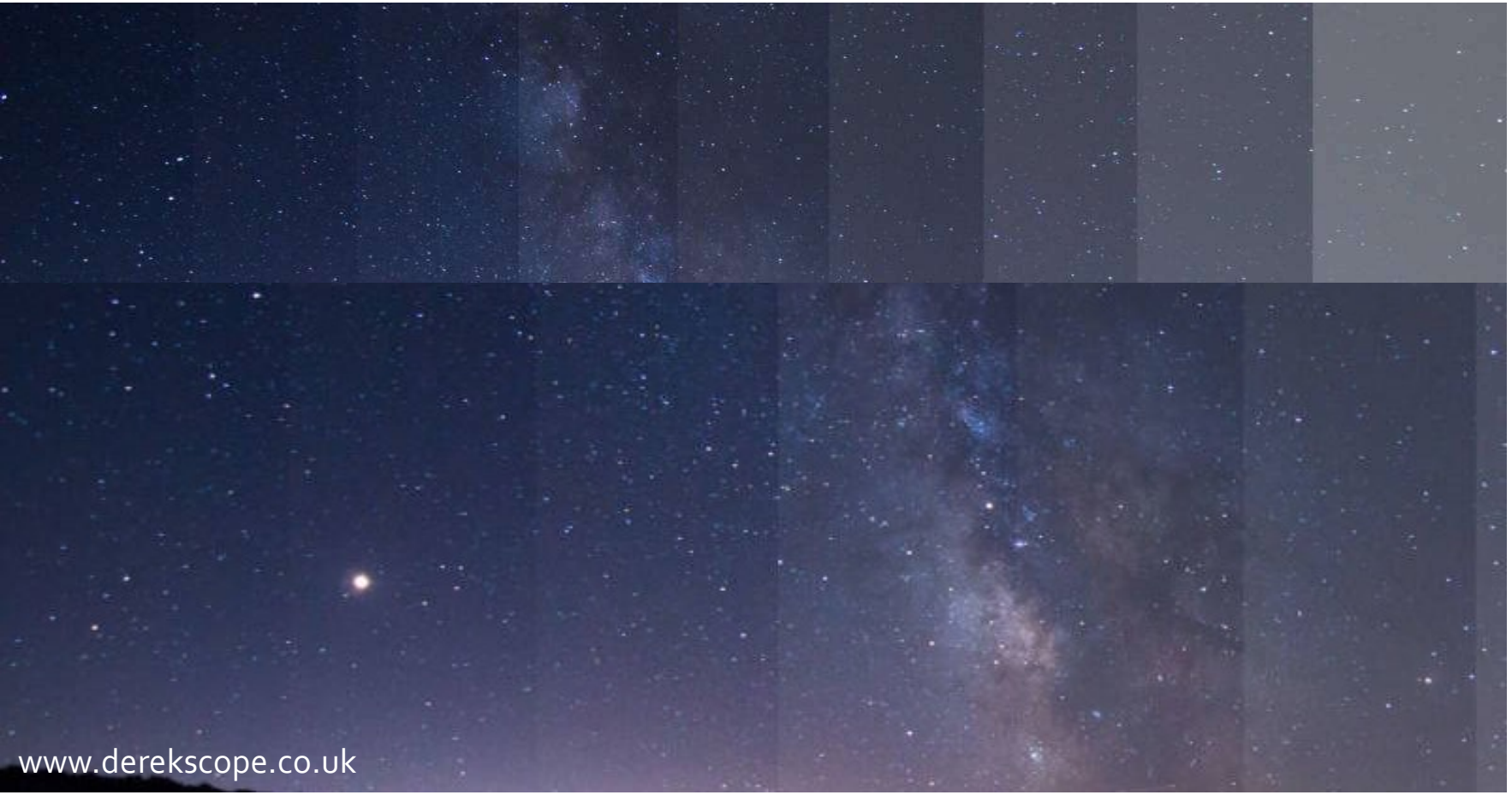
Glimpse of an Urban Sky



Looks bad, but how bad is it really?

The Bortle Scale



- Proposed by John Bortle in Feb. 2001 Sky & Telescope magazine
- Used to evaluate & compare observing sites

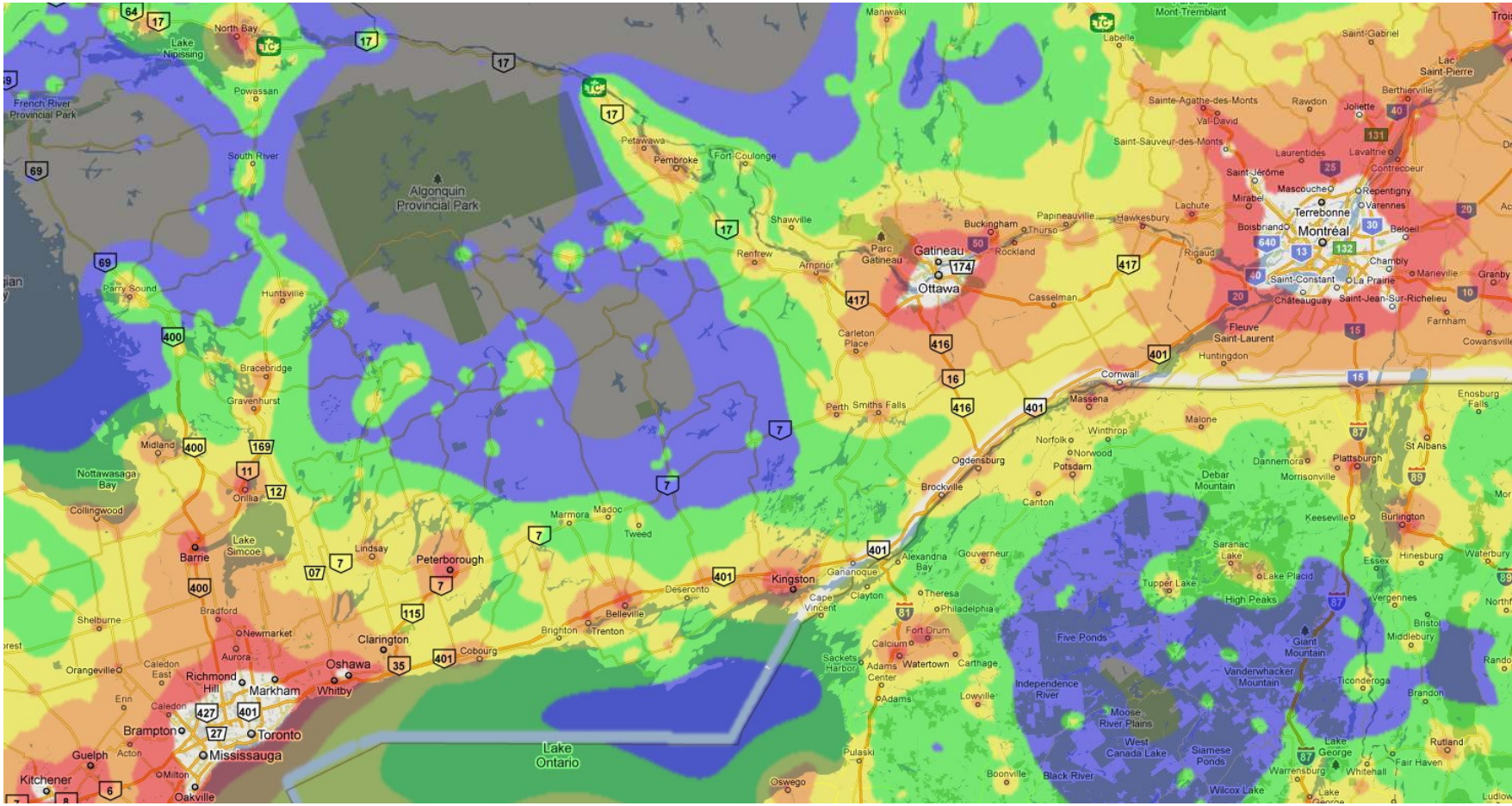
What's My Bortle?

Subjective scale

Bortle	Title	Description
1	Excellent dark sky	Milky Way casts shadow, lost in stars!
2	Typical dark sky	Milky Way striking, airglow visible
3	Rural sky	Faint light domes, more naked eye objects
4	Rural/suburban sky	Light domes, many stars, bright objects
5	Suburban sky	Glow on horizon, Milky Way clearly visible
6	Bright suburban	Horizon grey, Milky Way just barely visible
7	Suburban/urban sky	Light grey sky, star clusters, bright objects
8	City sky	Grey sky, make out some constellations
9	Inner-city sky	Bright sky, few stars, Moon & planets

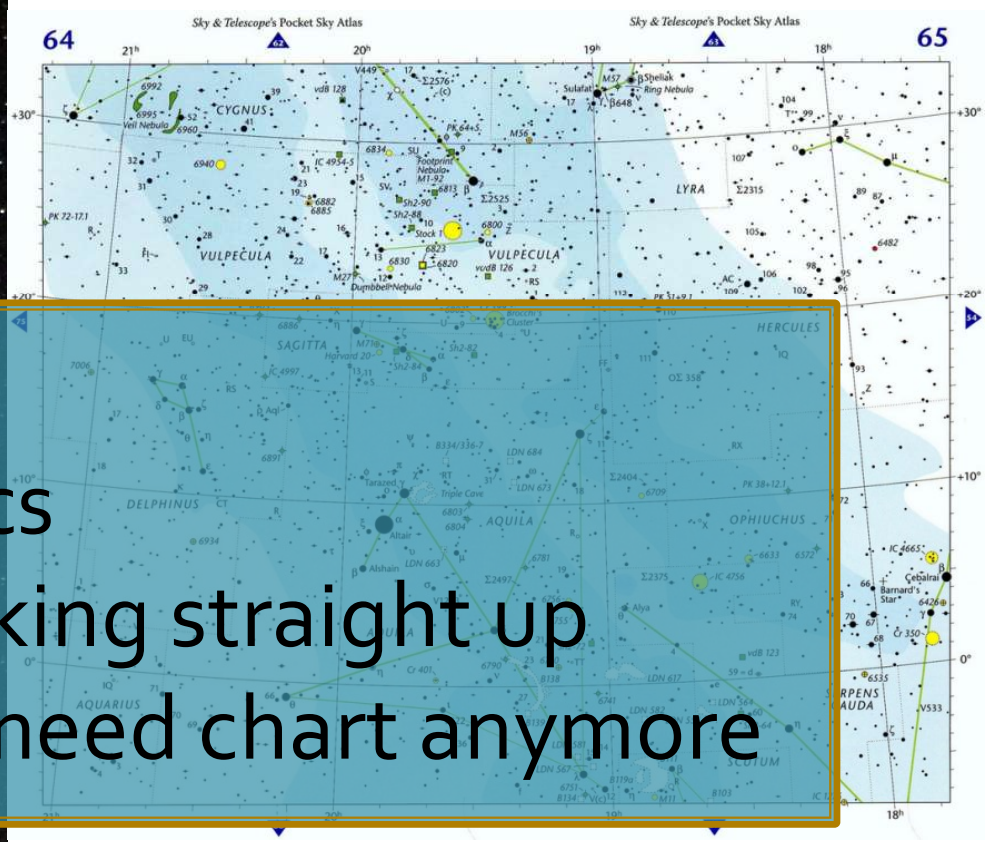
Dark Sky Maps

- Lots of resources online
- Based on sat. data
- Ottawa B8-9+
- FLO B5
- 90min drive to B2



Naked Eye Limiting Magnitude

1. After dark adapted, look up
2. Find faintest star you can see
3. Find magnitude from star chart

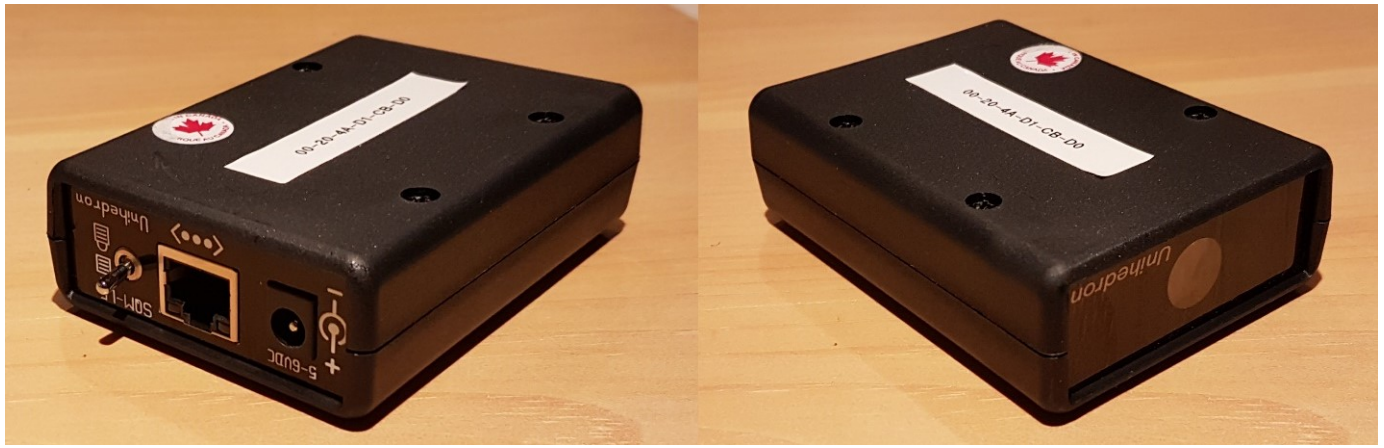


- Quick + easy
- Don't need electronics
- Normally quoted looking straight up
- With practice, won't need chart anymore

Sky Quality Meter

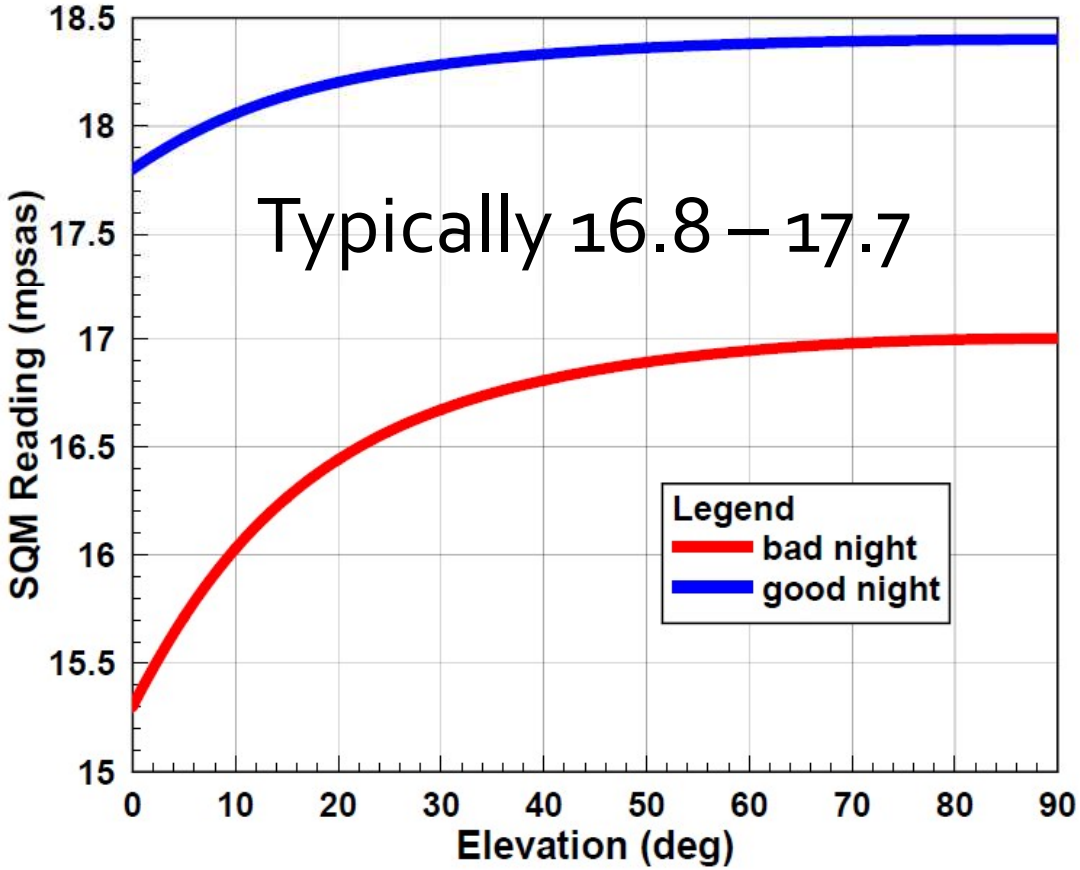
Made In Canada (unihedron.com)

- Calibrated brightness meter
- Brightness in Mags per square arc second
  - Bigger number = darker sky
- Relatively inexpensive device (~$150)



My Backyard SQM Readings

- Reading varies with:
  - Direction (elevation)
  - Sky conditions
- Variation with angle greater on bad nights



Sky Brightness Scales Compared

Bortle	NELM*	MPSAS**	
1	7.6-8.0	25.0+	
2	7.1-7.5	23.2-25.0	
3	6.6-7.0	21.9-23.2	
4	6.1-6.5	20.9-21.9	
5	5.6-6.0	20.2-20.9	
6	5.1-5.5	19.4-20.2	
7	4.6-5.0	18.8-19.4	
8	4.1-4.5	18.2-18.8	
9	<4.0	<18.2	
9+	**2.9-3.7**	**16.8-17.7**	**20580-8980**

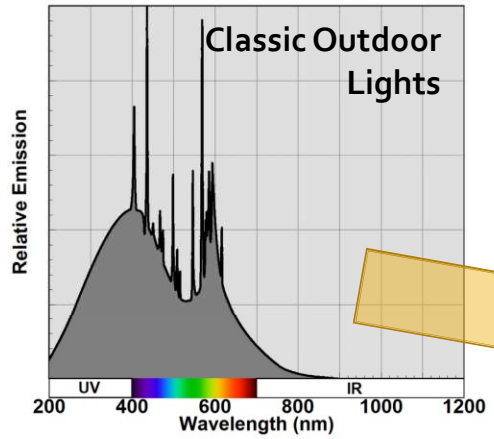
*NELM = Naked Eye Limiting Magnitude

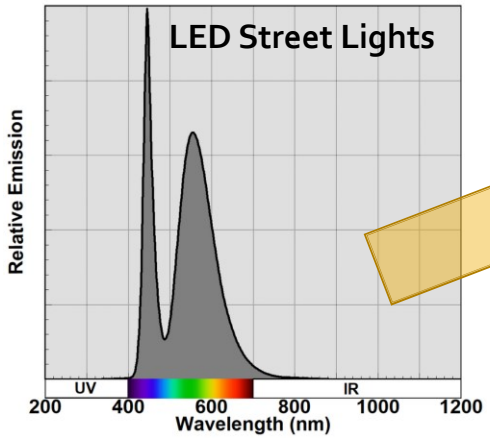
**MPSAS = Mags Per Square Arc Second

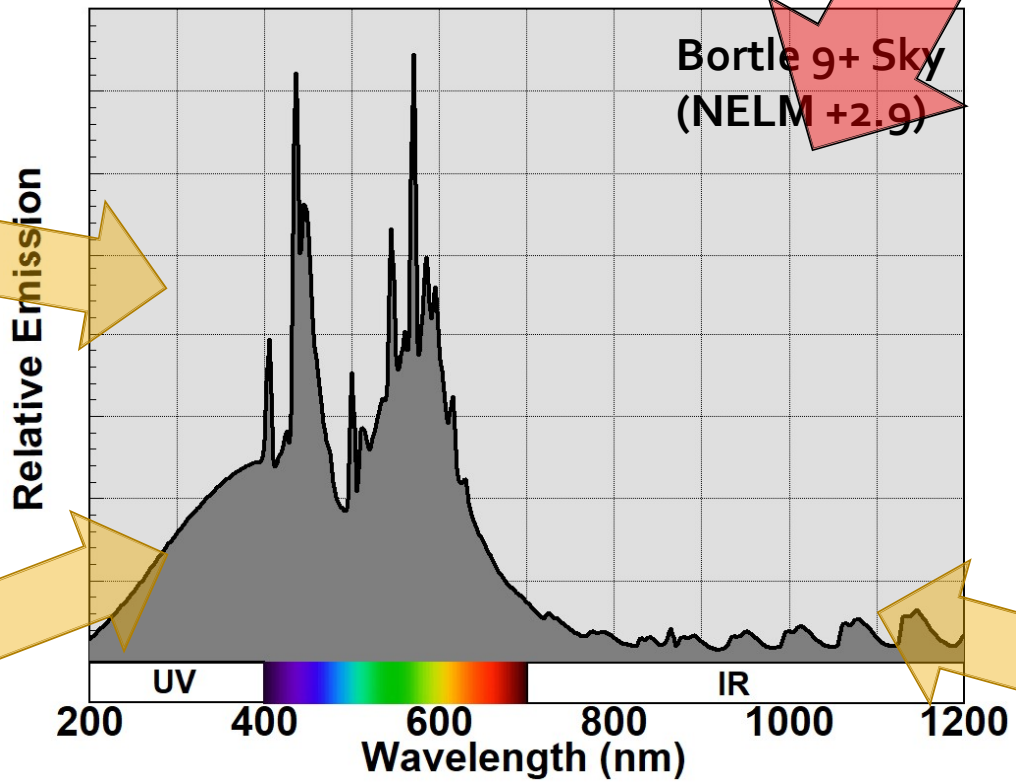
My backyard!

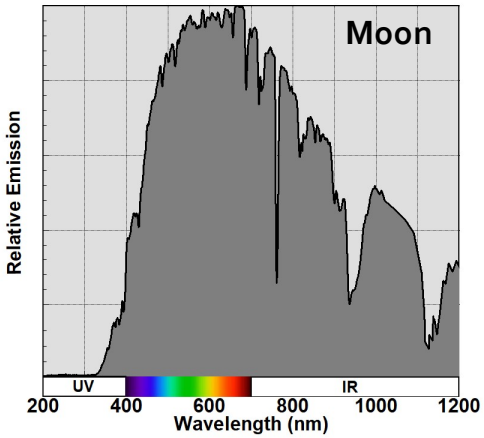
The Spectrum of LP

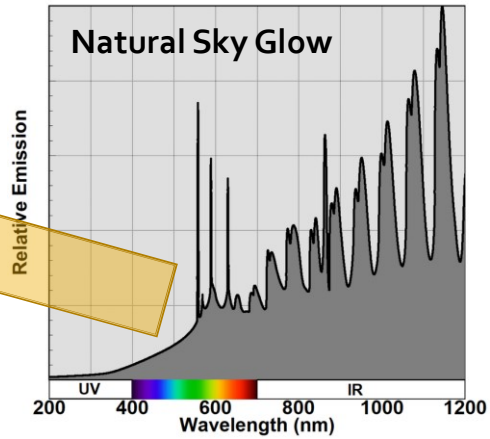
Educated Guess!









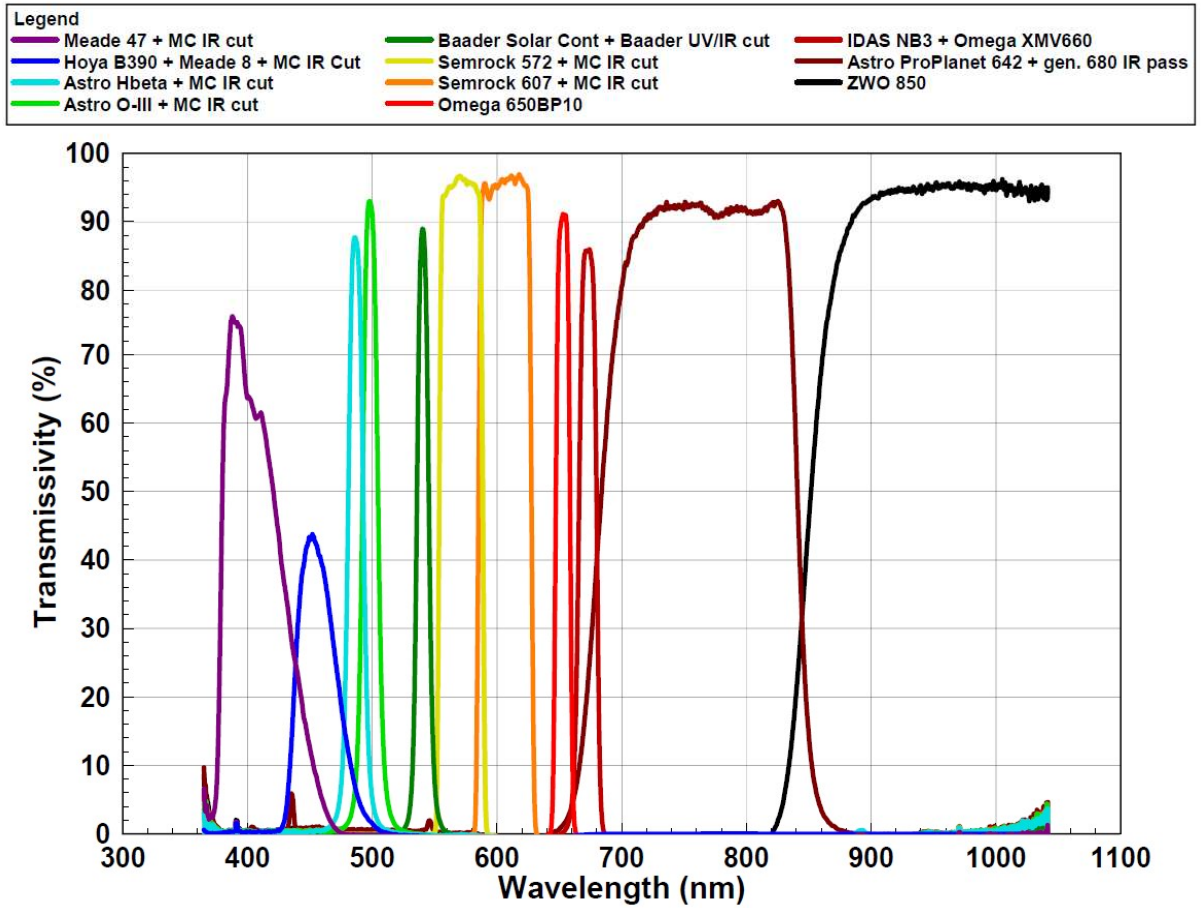


Measuring Sky Spectrum

- Telescope + EAA
  - Crazy enough to

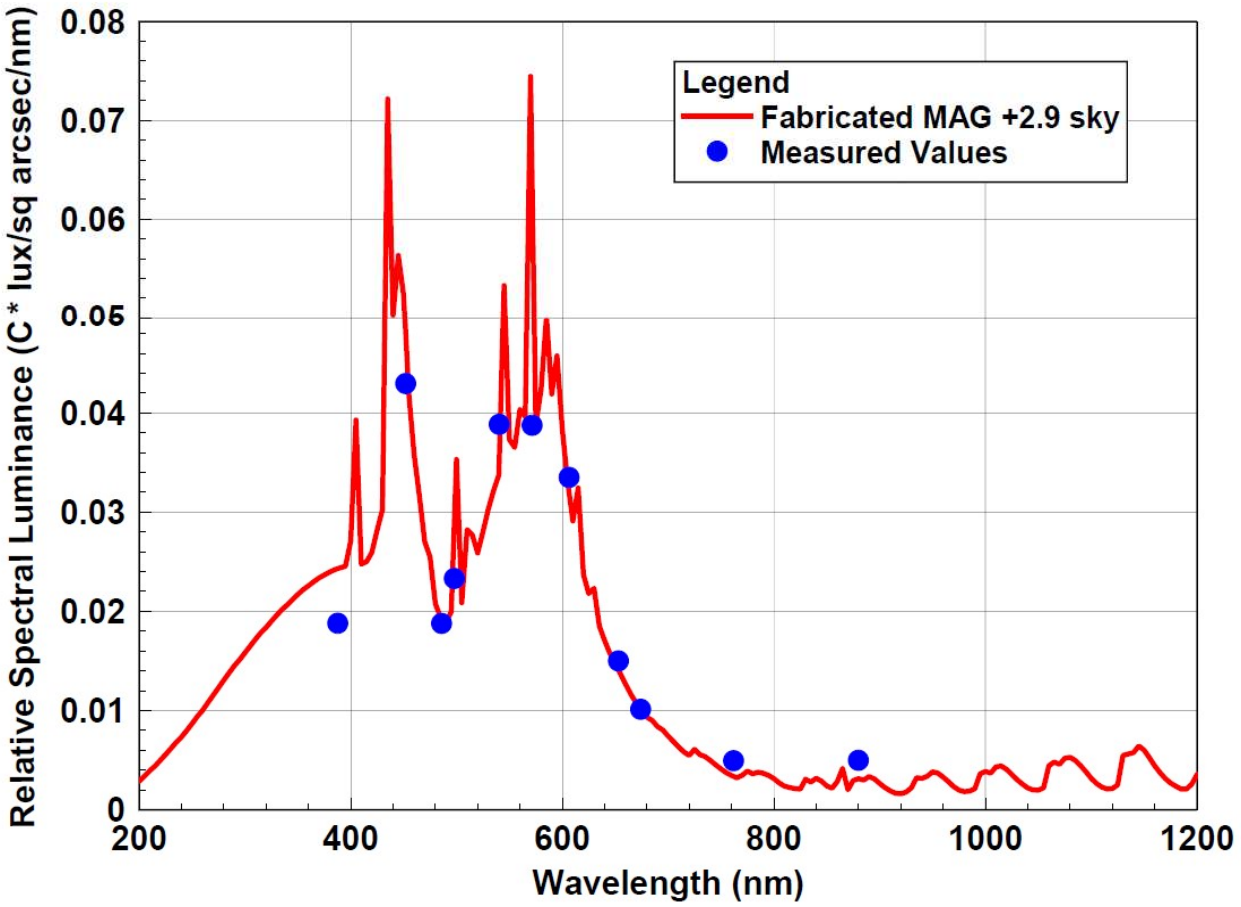
Sky Spectrum Data Gathering

- From my existing library find 11 band pass filters
- Aim telescope south at 45° elevation (OoF)
- Capture monochrome image – no filters = REFERENCE
- Capture image with each filter – same camera settings
- Measure filter spectra w/ bench top spectrometer



Sky Spectrum Data Reduction

- **Known:**
  - % light getting through filter (from spectrum data)
  - % light picked up by camera w/filter (from images)
- **Find:**
  - Relative contribution to total image brightness in each filter pass band
  - Scale points uniformly to achieve best fit
- **Result:**
  - Very good match to assumed sky spectrum
  - UV bit too high, IR bit too low



Conclusions

- Methods of evaluating your own sky quality provided
- Spectrum of Ottawa LP consistent with expectations

- QUESTIONS?