Multi-Wavelength Reverberation Mapping Survey Synergies Between Future Facilities

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| INTRODUCTION |

In the present era of active galactic nuclei (AGN) science, multi-wavelength surveys are gaining ground. The use of reverberation mapping (RM; Peterson et al. 1983) as a powerful technique to extract AGN sizes from their varying fluxes has flourished over the past decades. Next-generation facilities, e.g., the *Cosmological Advanced Survey Telescope for Optical and ultraviolet (UV) Research* (*CASTOR*; P.I.: P. Côté)– a proposed mission led by Canada, will perform large-scale RM surveys. We are contributing to the planning of such surveys by developing an AGN Survey Simulator tool (Khatu 2022, PhD thesis). Although a stand-alone RM program with *CASTOR* is feasible, synergies with other facilities coming up in the future will allow maximizing the science outcomes from AGN RM surveys.
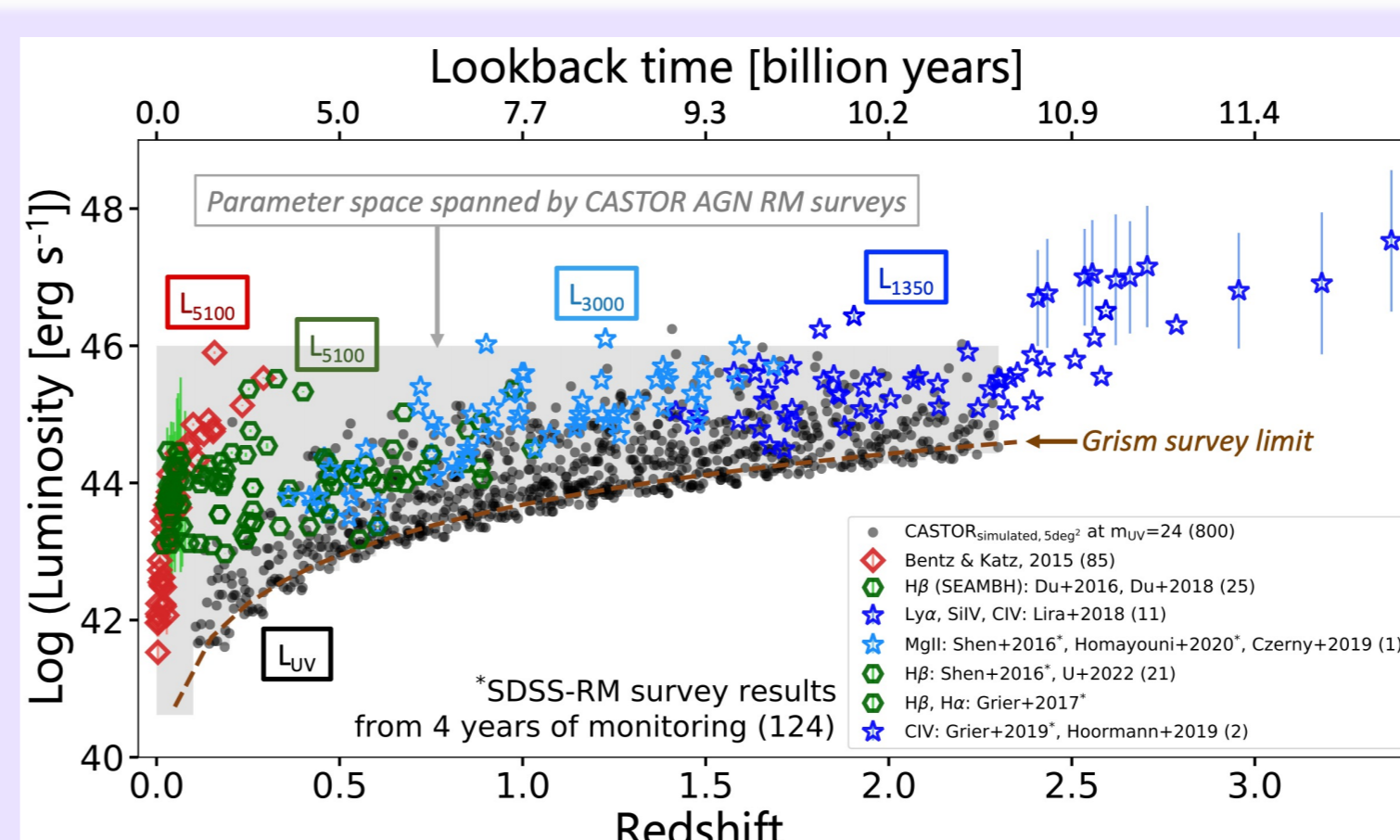
Photometry (*UV*, *u*, and Rubin/*g*) + Grism (*UV* and *u*) + UV Multi-Object Spectroscopy (*UV* and *u*)
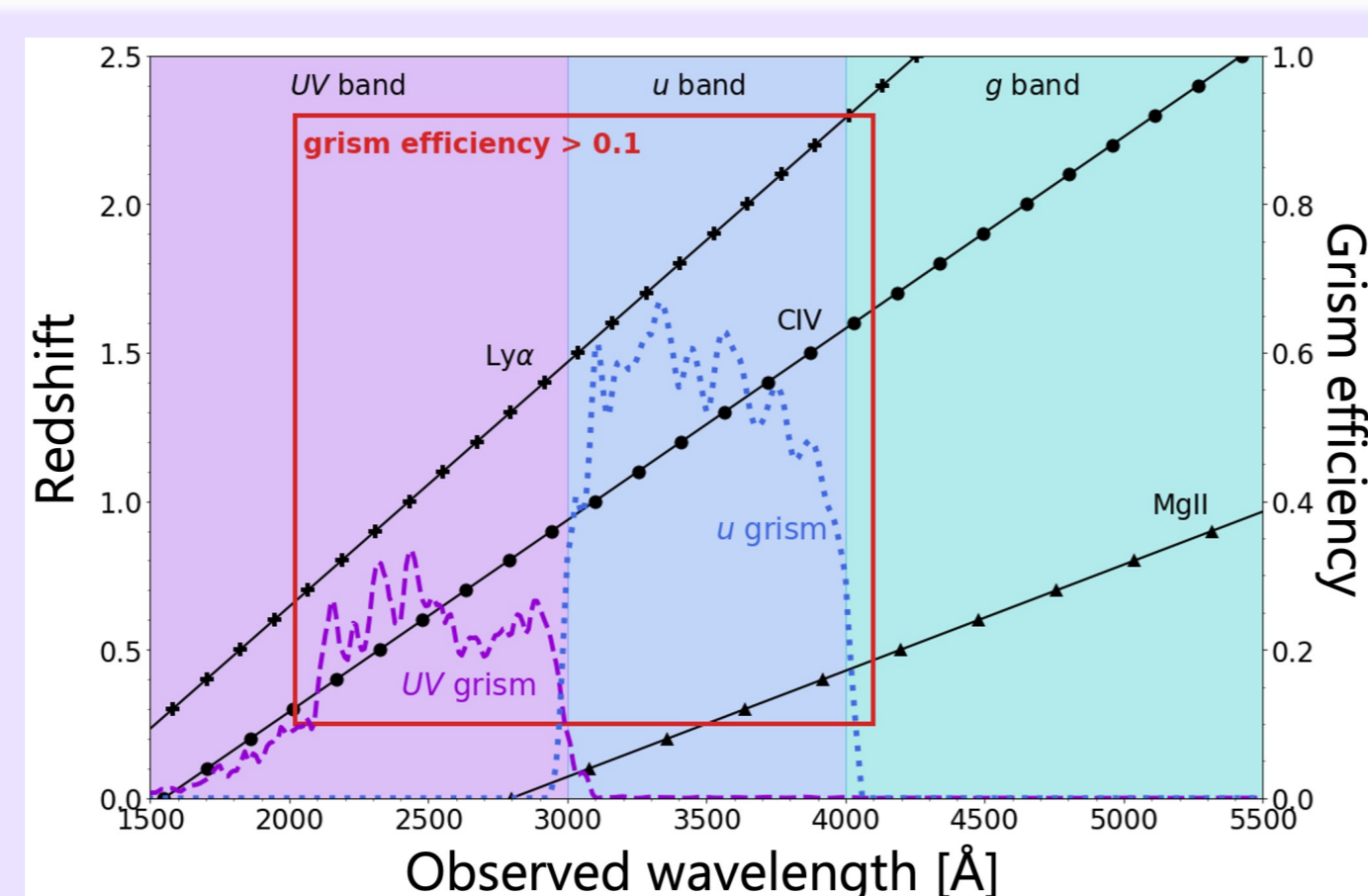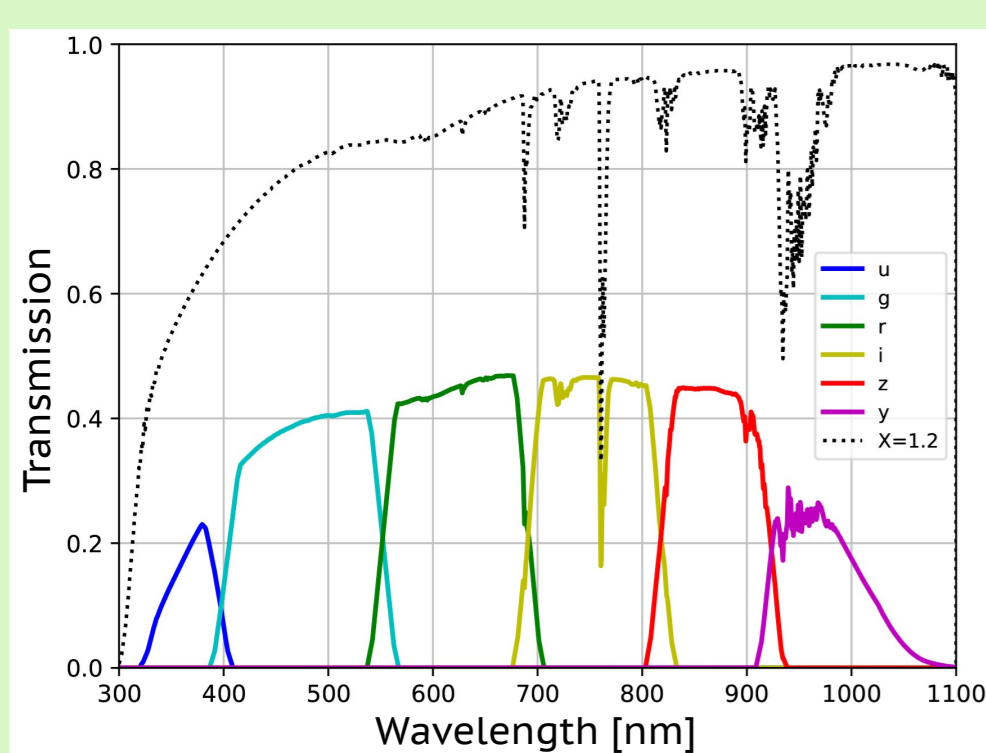
CASTOR
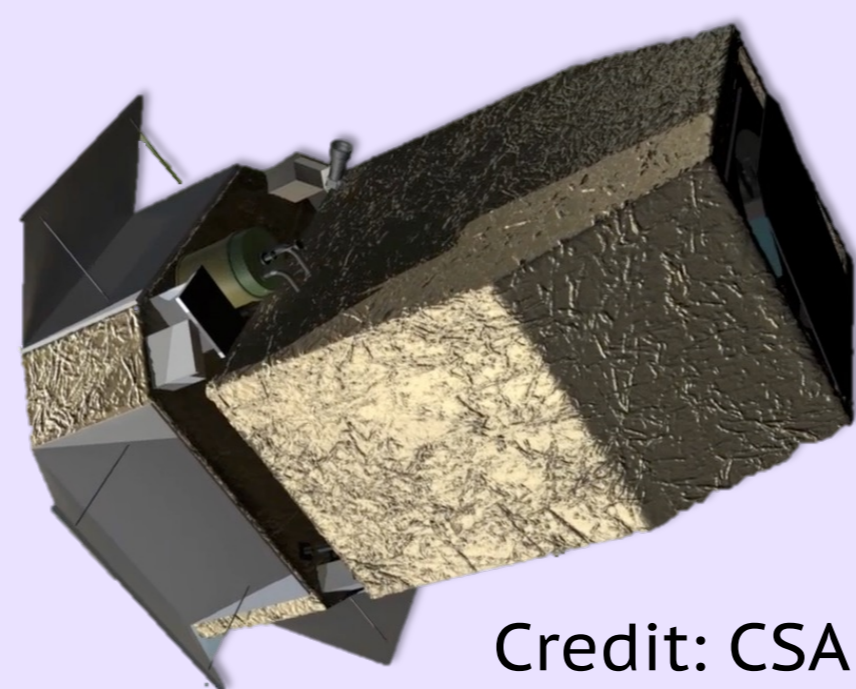
Credit: CSA

AGN Legacy Survey aims to measure black hole masses of a significantly large number of AGN in a unique phase space

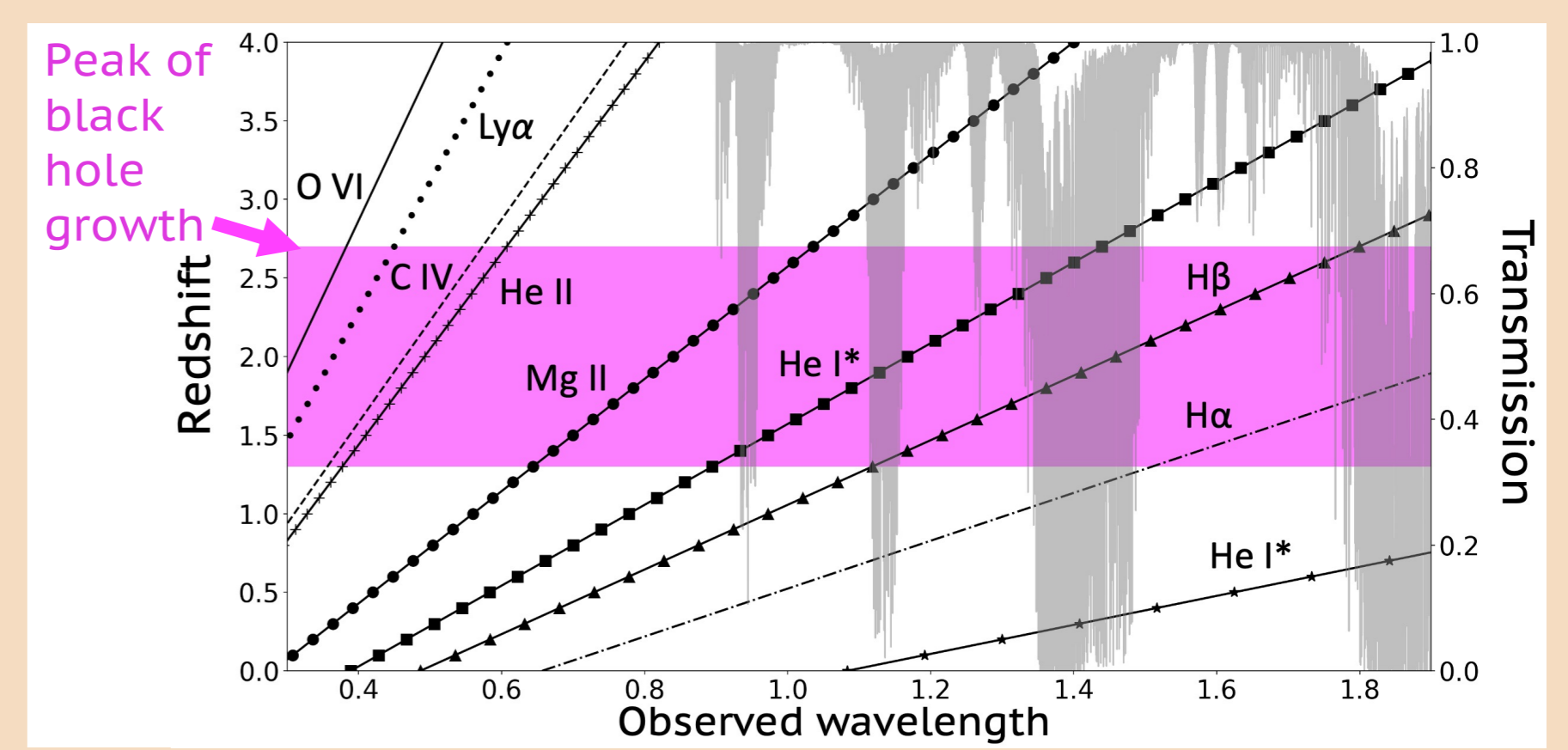### Vera C. Rubin Observatory (Rubin)

Credit: Ivezić et al. (2019)

Credit: Rubin/NSF/AURA

- High cadence + long baseline for RM studies
- Science: Accretion-disk RM + construction of spectral energy distributions for AGN in Rubin Deep Drilling Fields

Fig. 1. AGN Survey Synergies

Maunakea Spectroscopic Explorer (MSE)

Credit: MSE

- Probe high redshift, high luminosity AGN: Hβ, MgII
- Science: Accretion-disk and BLR RM + follow-up high-resolution spectroscopy of *CASTOR* targets

| AGN SURVEY SIMULATOR (USE CASE: *CASTOR*) |
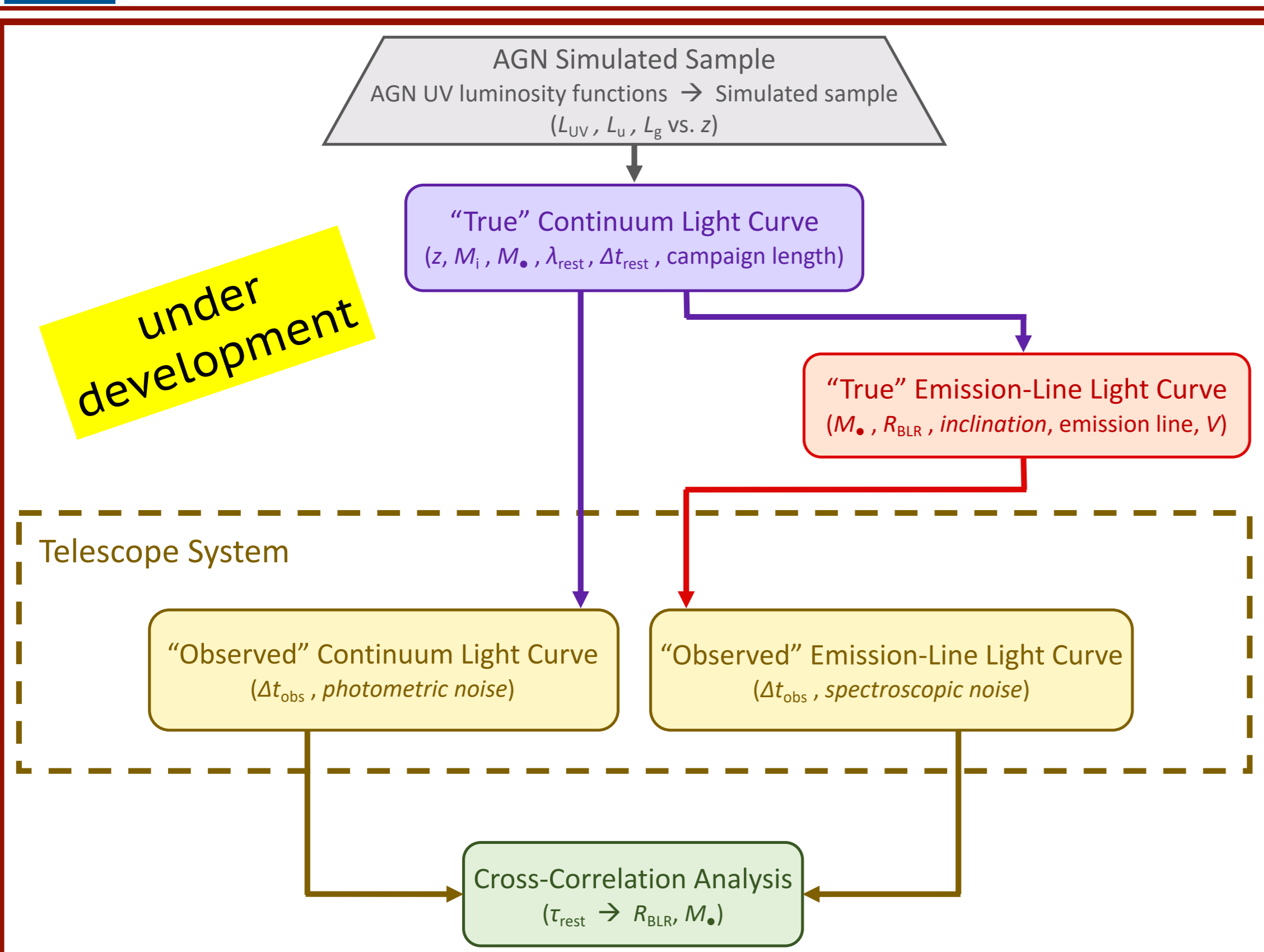
under development

Fig. 2. AGN Survey Simulator design with modular framework. (Language: Python)

Fig. 3. Illustration 1 (Khatu 2022, PhD thesis) – Higher redshift, higher luminosity (larger symbols) AGN need longer campaigns. In a nominal, 1-year period, *CASTOR* will probe AGN with $L_{AGN} < 10^{46.0}$ erg s^{-1}.
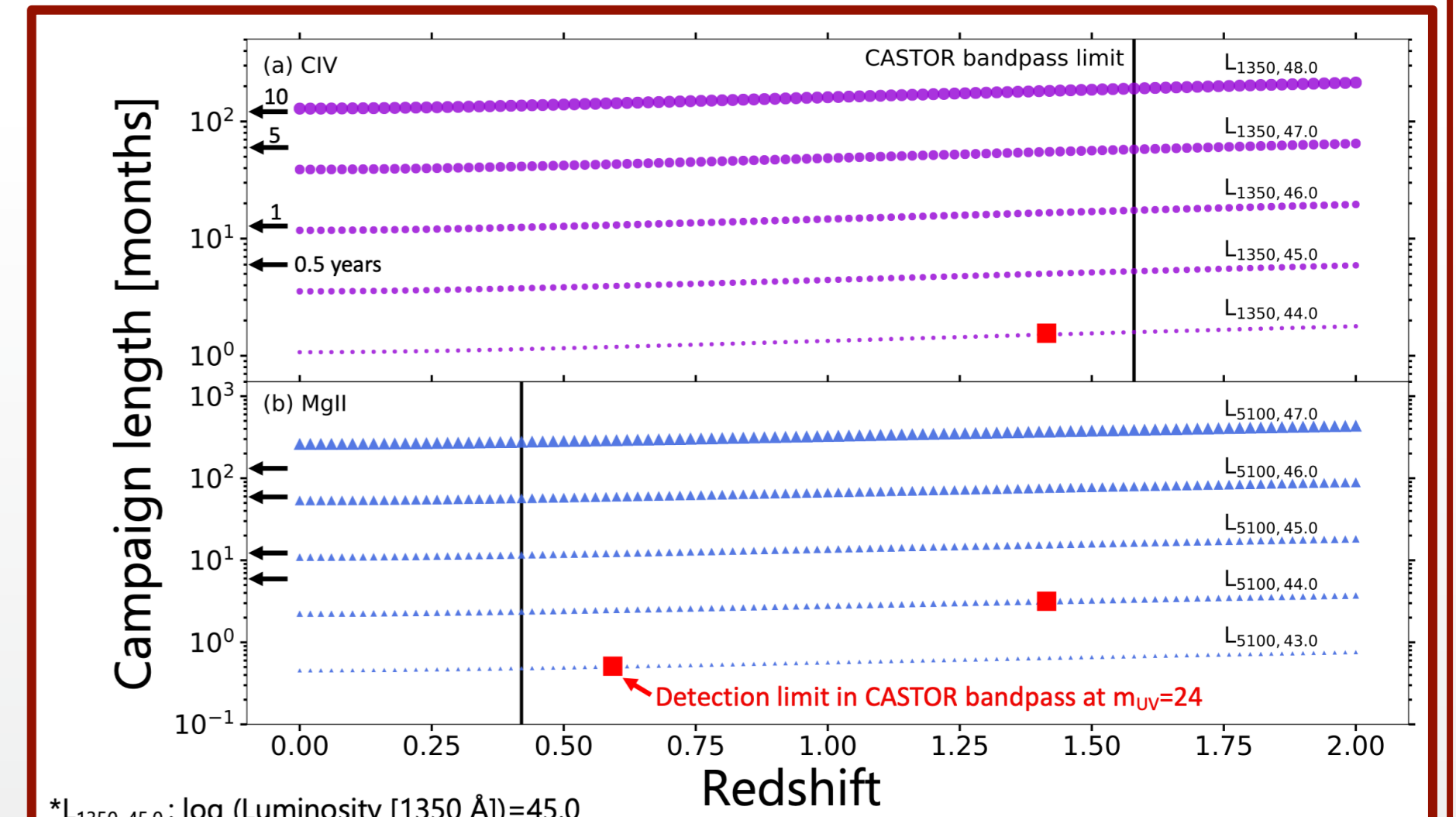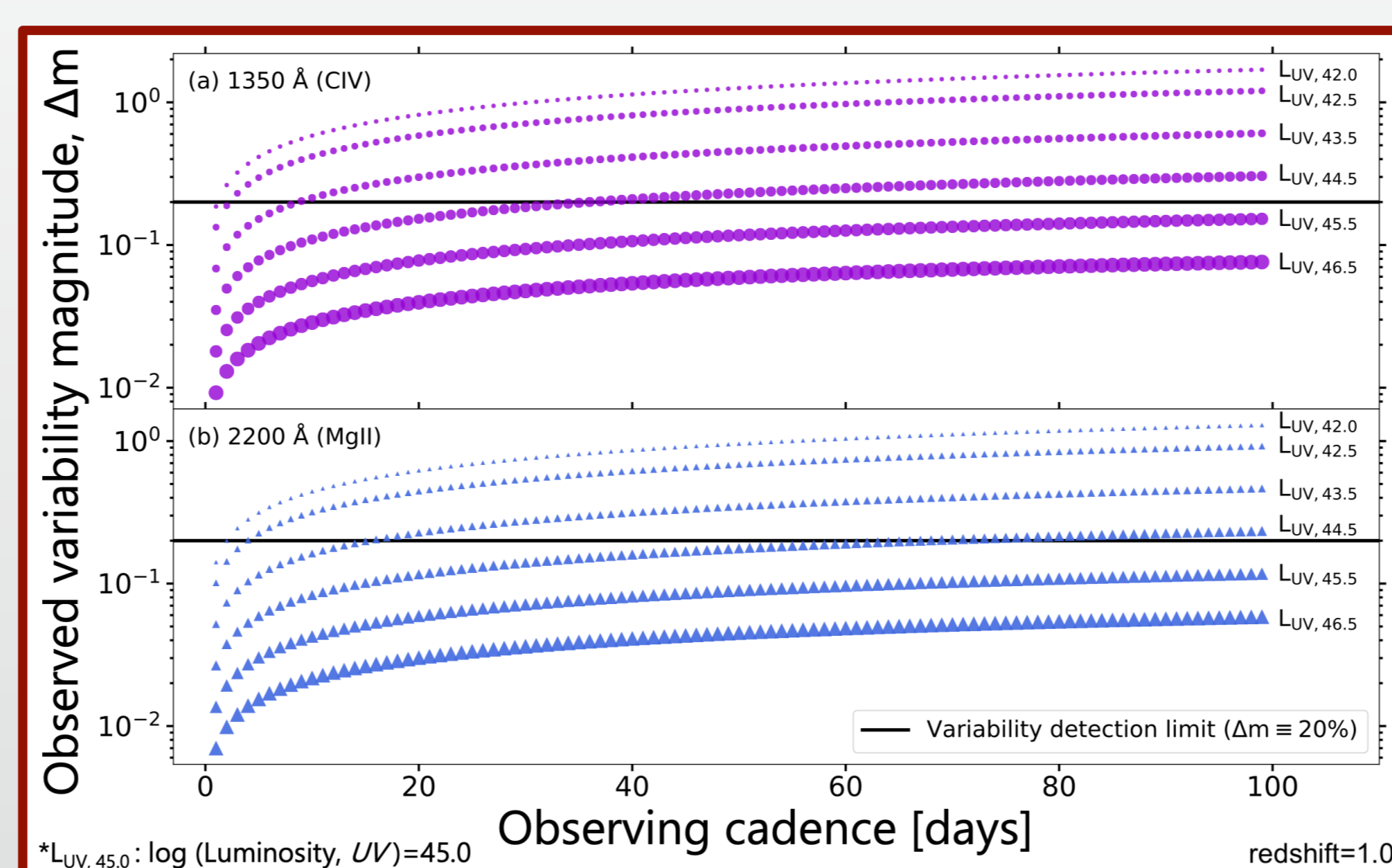
Fig. 4. Illustration 2 (Khatu 2022, PhD thesis) -- For more luminous AGN, we need longer cadences to detect sufficient variability (Δm ≳ 20%) in these objects.

| FUTURE WORK |

- Testing forward modelling techniques for grism spectral analysis in the low-count regime.
- Adapting the simulator for MSE survey planning

| ACKNOWLEDGEMENTS |