

**Title:** The necessity of flags indicating known AGN

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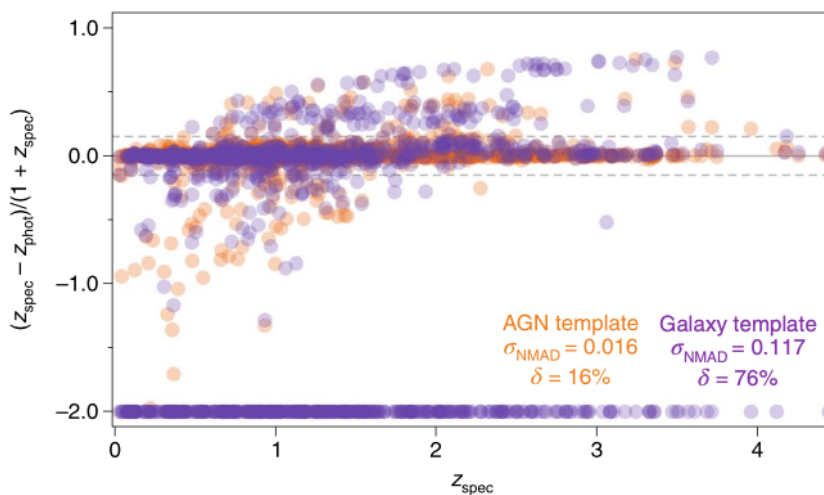
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## 0. Summary Statement

We discuss the importance of a flag indicating if a source has been classified as hosting an AGN (or high-fidelity AGN candidate) in the literature (e.g., via variability, spectroscopy, X-ray/optical/IR photometry). This will alert the community that the photometric redshift and physical parameters, currently planned in the DM photo-z roadmap ([DMTN-049 2](#)) to be computed under the assumption that every object is a galaxy, are suspect given that the AGN contribution is not accounted for at any stage. This can lead to potentially catastrophic redshift errors and biased physical parameters.

### 1. Scientific Utility

Due to its unprecedented depth, the great majority of objects detected by the LSST will lack spectroscopic follow-up observations. Science investigations will require that users rely on photometric redshifts for most extragalactic sources. The current plan from DM is to provide to the community with photometric redshifts computed under the assumption that all extragalactic sources are galaxies, ignoring that a non-negligible fraction of them will host an AGN. In the best scenario, when the AGN dominates, the photometric redshift procedure will fail (NULL result); but in the rest of the cases an unreliable photometric redshift will be computed (see Fig.1 from Salvato, Ilbert & Hoyle, 2019), thus affecting also the estimate of the physical parameter: in addition to be computed at the wrong redshift, will not account for the AGN component, with the net result of over-estimating stellar mass and SFR.



**Figure 1:** Difference between photo-z obtained using either galaxy (violet) or AGN (orange) templates for sources that are AGN detected in COSMOS and with a reliable spec-z. For the 33% of sources, no suitable normal galaxy template could be used to compute the photo-z; we artificially set the photo-z to -2. Credit : Salvato, Ilbert & Hoyle, 2019.

In the literature there are plenty of catalogs of reliable AGN candidates selected in X-rays (e.g., ROSAT, *XMM* and *Chandra*), optical (SDSS) and MIR (e.g., WISE), just to mention the largest ones. And this is just what is currently available. By the time that LSST will make the first release, eROSITA will provide a new list of  $\sim 10^6$  X-ray detected AGN, while DESI will provide millions of new spectroscopic AGN identifications. For future releases, LSST will also identify a large number of new AGN, either alone (e.g., via variability) or when paired with multi-wavelength observations ([see this LoR](#)).

While the AGN SC aims to collate this information in a unique catalog, DM should consider cross-matching this list with the LSST catalog to generate an AGN flag.

In addition, DM should also select at least one versatile photo-z estimator that can work for AGN and galaxies at the same time.

### **3. References**

Salvato, M., Ilbert, O., & Hoyle, B. 2019, *Nature Astronomy*, 3, 212