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Supermassive black holes hidden in the outskirts of galaxies

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Abstract. Ultra-Compact dwarf galaxies, which inhabit the outskirts of galaxies, may conceal a significant population of hitherto overlooked super-massive black holes.

Keywords.

Ultra Compact Dwarf Galaxies (UCDs) are pressure supported stellar systems intermediate between dwarf galaxies and star clusters (e.g. Hilker *et al.* 1999, Drinkwater *et al.* 2000). Cosmological simulations (e.g. Pfeffer *et al.* 2016) suggest that a fraction of UCDs are remnants of tidal disruption of intermediate mass ($<10^{10}$ M_*) galaxy halos. If so, those UCDs should carry a relic of their progenitor galaxy in the form of a massive central black hole. At present this would offset UCDs from the well known M_{BH}-L relation of galaxies (e.g. Graham & Scott 2013). It is interesting to note that dynamical mass-to-light ratios of UCDs are higher than expected from their stellar populations (e.g. Mieske *et al.* 2013). This finding is consistent with the hypothesis that supermassive black holes in the centers of UCDs elevate the global velocity dispersion of stars in UCDs (Frank *et al.* 2011, Mieske *et al.* 2013). Within that scenario, the measured dynamical M/L ratios suggest super-massive black hole masses of the order of 10-15% of the UCD mass.

To test the hypothesis that UCDs harbour over-massive central black holes, we targeted with Gemini North NIFS LGS the Virgo cluster UCD M60-UCD1 (Seth *et al.* 2014). We find that M60-UCD1 has the clear kinematic signature of a supermassive central black hole with 2×10^7 M_*, making up 15% of the UCD mass itself (it also is an X-ray emitter, Strader *et al.* 2013). This places M60-UCD1 almost 2 dex off the relation between bulge luminosity and central BH mass. Thus our finding indeed suggests that M60-UCD1 is a tidally disrupted remnant of a more massive progenitor of about 10^{10} M_*! The next step is to assess whether SMBHs in UCDs are a common feature, thus altering our census of SMBHs in the local universe. To this end we have embarked on a joint Gemini North + VLT campaign targeting about a dozen UCDs, for which data acquisition is ongoing.

References

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