

Summary of PhD thesis

This PhD thesis constitutes a thorough investigation into the foremost role played by supermassive black holes within the context of galaxy evolution. Supermassive black holes in local galaxies obey a surprisingly large number of scaling laws that involve the black hole mass and various properties of the host galaxy. These “black hole mass scaling relations” reveal a strong symbiosis between galaxies and black holes, define important constraints about their co-evolution through the cosmic time, and set the boundary conditions for theoretical models and simulations of galaxy formation. By means of the most sophisticated analysis of galaxy structures performed to date, using state-of-the-art modelling techniques applied to the hitherto largest sample of galaxies with a reliable measurement of the black hole mass, this thesis enhances and refines our knowledge about the intimate relation between supermassive black holes and their host galaxies, and discusses important implications for galaxy evolution models.

The most significant outcome of this research work has been the debunking of several independent claims of “overmassive” black holes. Upon inaccurately modelling the structure of a number of peculiar galaxies, some recent studies have concluded that these galaxies host black holes that are abnormally too massive, that is, they constitute an exception to the rule. However, this work robustly demonstrates how and why these galaxies have not been correctly modelled, and rules out the possibility that their black holes are exceptional by any means. This result not only nullifies the need for invoking different evolutionary scenarios for these peculiar galaxies but it strengthens the significance of the observed “black hole mass scaling relations” and confirms their importance as fundamental ingredients for theoretical models of galaxy evolution.

List of publications:

1. **Savorgnan, G. A. D**
Supermassive Black Holes and their Host Spheroids III. The $M_{\text{BH}} - n_{\text{sph}}$ Correlation.
ApJ, 821, 88. 2016.
doi: 10.3847/0004-637X/821/2/88
2. **Savorgnan, G. A. D.**, Graham, A. W.
Explaining the reportedly over-massive black holes in early-type galaxies with intermediate-scale discs.
MNRAS, 457, 320. 2016.
doi:10.1093/mnras/stv2713
Citations: 7.
3. **Savorgnan, G. A. D.**, Graham, A. W.
Supermassive black holes and their host spheroids I. Disassembling galaxies.
ApJS, 222, 10. 2016.
doi:10.3847/0067-0049/222/1/10
Citations: 7.
4. **Savorgnan, G. A. D.**, Graham, A. W., Marconi, A., Sani, E.
Supermassive black holes and their host spheroids II. The red and blue sequence in the $M_{\text{BH}} - M_{*,\text{sph}}$ diagram.
ApJ, 817, 21. 2016.
doi:10.3847/0004-637X/817/1/21
Citations: 8.
5. **Savorgnan, G. A. D.**, Graham, A. W.
Overmassive black holes in the $M_{\text{BH}} - \sigma$ diagram do not belong to over (dry) merged galaxies.
MNRAS. 446, 2330. 2015.
doi:10.1093/mnras/stu2259

Citations: 13.

6. **Savorgnan, G. A. D.**, Graham, A. W., Marconi, A., Sani, E., Hunt, L. K., Vika, M., Driver, S. P.

The supermassive black hole mass - Sérsic index relations for bulges and elliptical galaxies.

MNRAS. 434, 387. 2013.

doi:10.1093/mnras/stt1027

Citations: 18.

7. Shankar, F., Bernardi, M., Sheth, R. K., Ferrarese, L., Graham, A. W., **Savorgnan, G. A. D.**, Allevato, V., Marconi, A., Laesker, R., Lapi, A.
Selection bias in dynamically-measured super-massive black hole samples: its consequences and the quest for the most fundamental relation.

Accepted for publication in MNRAS.

This publication has been the focus of a press release.

8. Graham, A. W., Durré, M., **Savorgnan, G. A. D.**, Medling, A. M., Batcheldor, D., Scott, N., Watson, B., Marconi, A.

A Normal Supermassive Black Hole in NGC 1277.

ApJ, 819, 43, 2016.

Citations: 3.

9. Graham, A. W., Dullo, B., **Savorgnan, G. A. D.**

Hiding in Plain Sight: An Abundance of Compact Massive Spheroids in the Local Universe.

ApJ, 804, 32. 2015.

This publication has been the focus of a press release.

Citations: 16.

Invitations to present the results from my PhD thesis as (fully funded) colloquium speaker:

- CSIRO, Macquarie University, Sydney. April 2016.
- ICRAR, University of Western Australia, May 2016.
- Sydney Institute for Astronomy, University of Sydney, date TBC.