

***AGN spectral states
from simultaneous UV and X-ray
observations by XMM-Newton***

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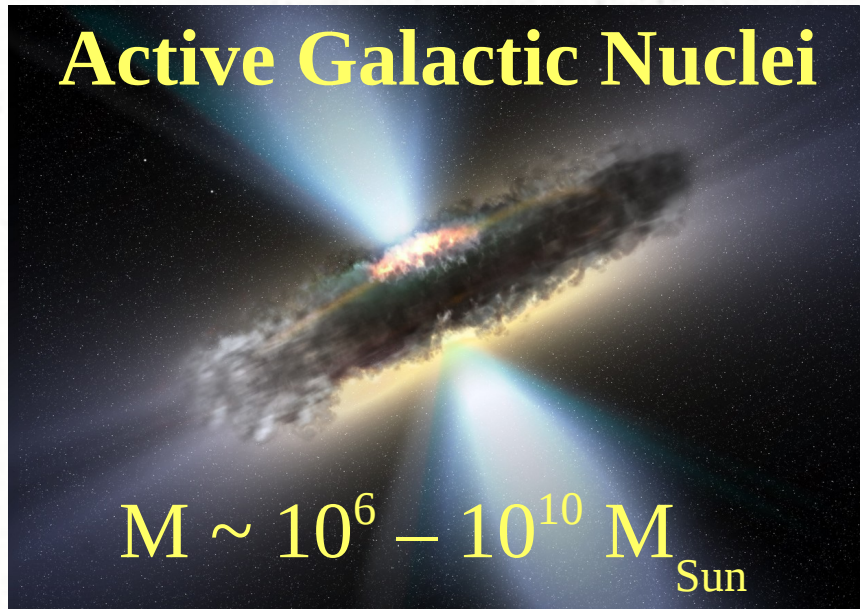
with *M. Guainazzi, A. Merloni*

*Thanks to: I. de la Calle, G. Ponti, B. de Marco, M. Giustini, G.
Miniutti, S. Motta, M. Cadole Bell*

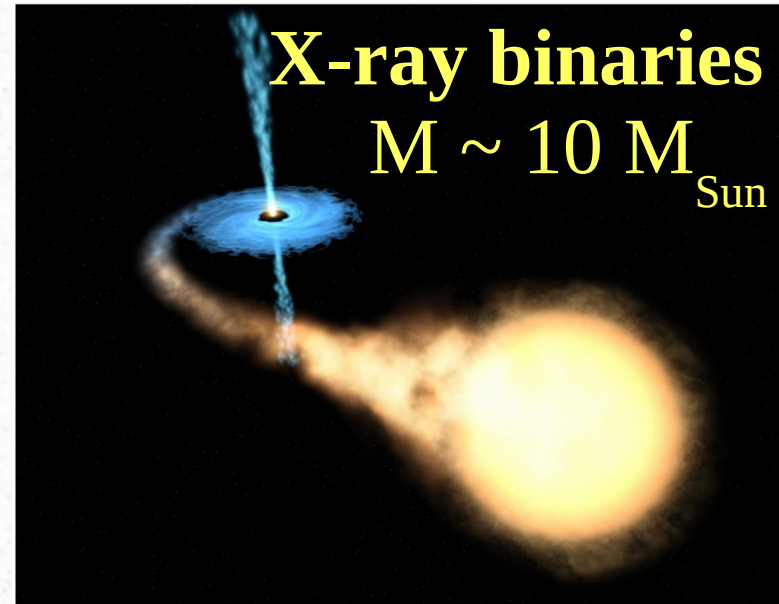
XMM-Newton: The Next Decade, ESAC, 10th May 2016

Black Holes at different scales

Active Galactic Nuclei

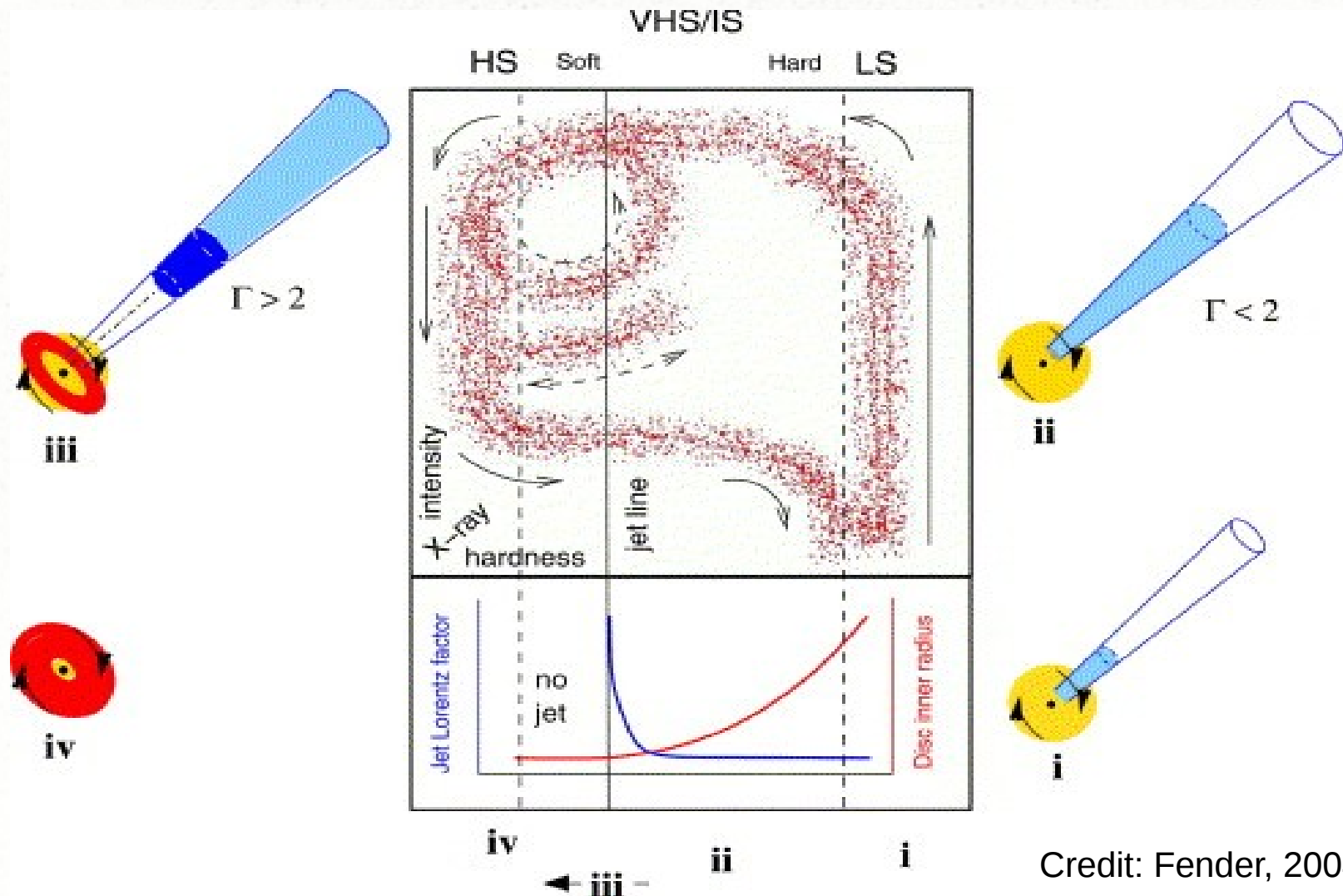


X-ray binaries



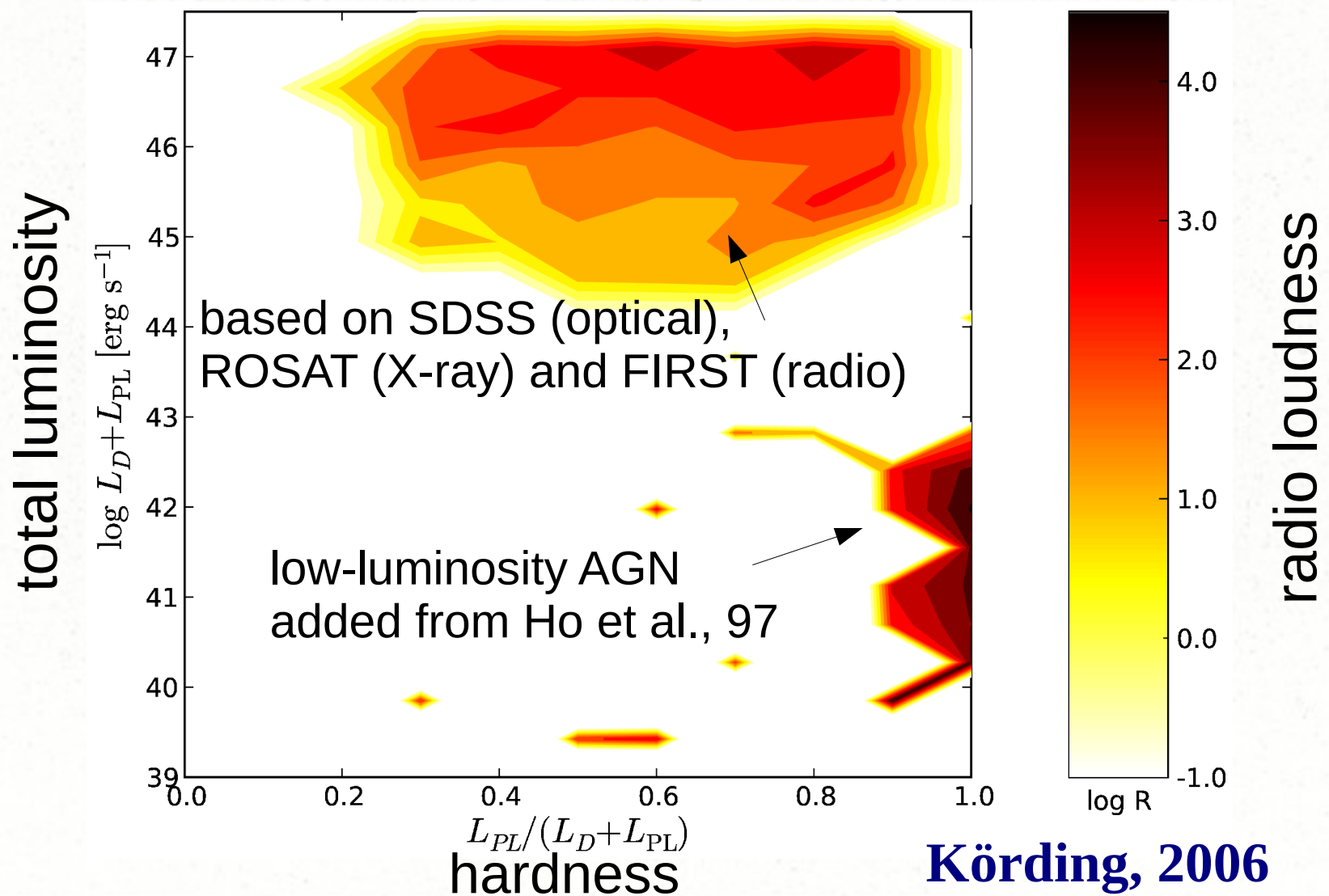
- how do these accreting black holes evolve?
 - are they changing the accretion states in a similar way?

Hardness-Intensity diagram for stellar-mass black hole binaries



Credit: Fender, 2004

AGN analogy to XRB

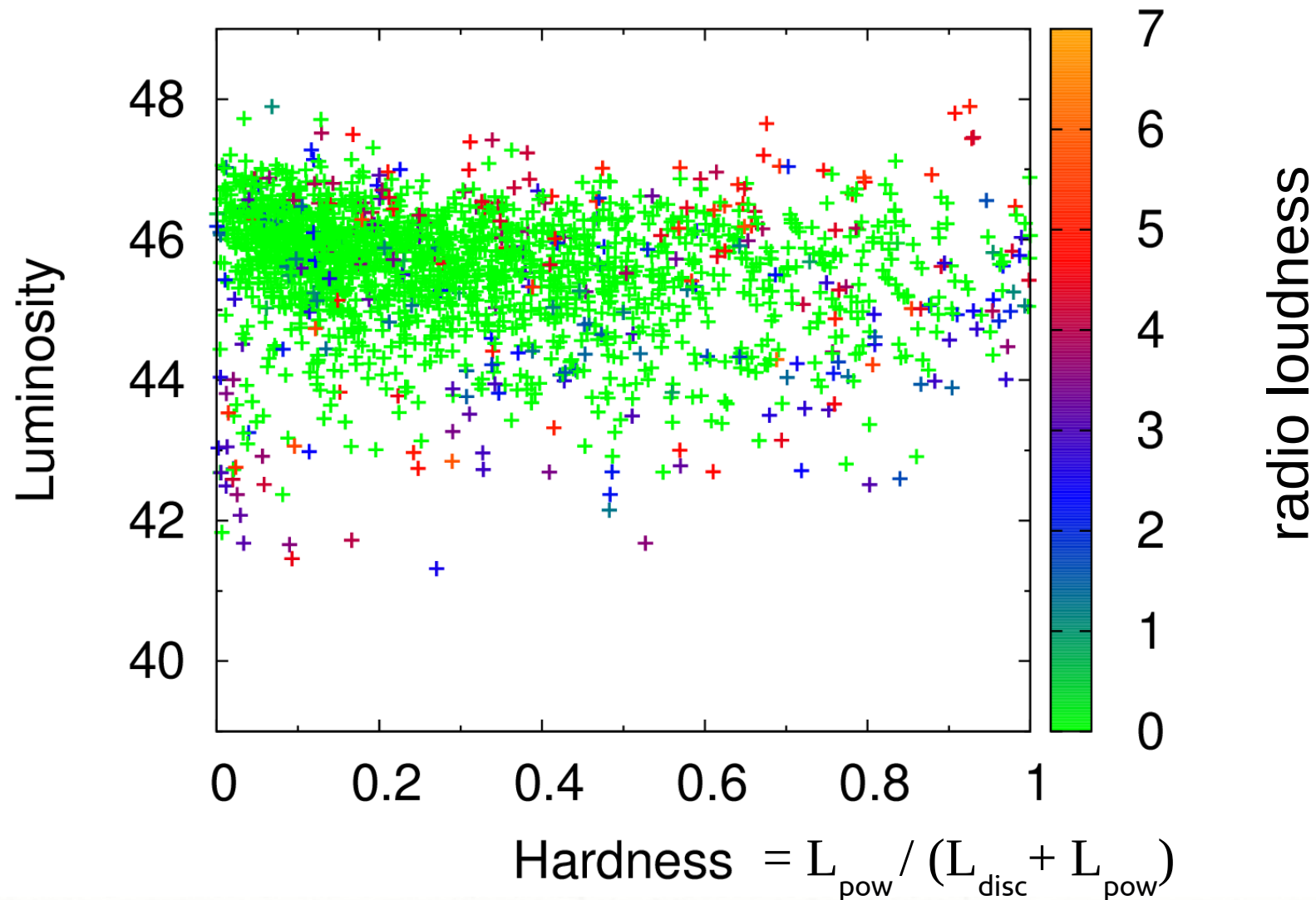


Körning, 2006

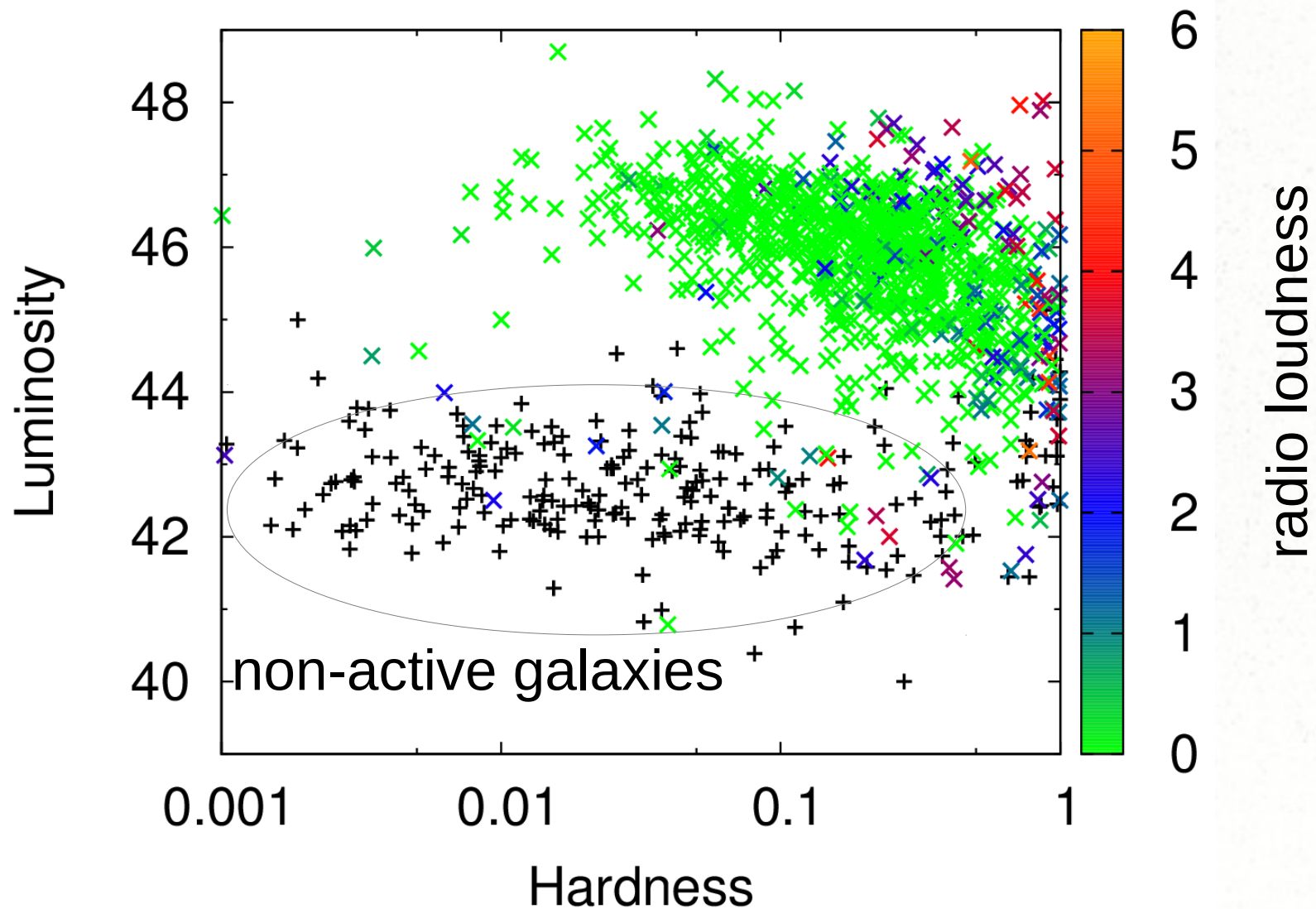
Our project with XMM-Newton

- only **strictly simultaneous** UV (Optical Monitor) and X-ray (EPIC-PN) data
 - => eliminate effect of the (X-ray) variability
- **non-thermal** emission constrained from directly measured **2-10 keV X-ray flux** *instead of an extrapolated flux from 0.1-2.4 keV (by ROSAT)*
 - => eliminate influence of the X-ray absorber
- **thermal** emission constrained from **UV flux** *instead of the optical magnitude (by SDSS)*
 - closer to the thermal-emission peak

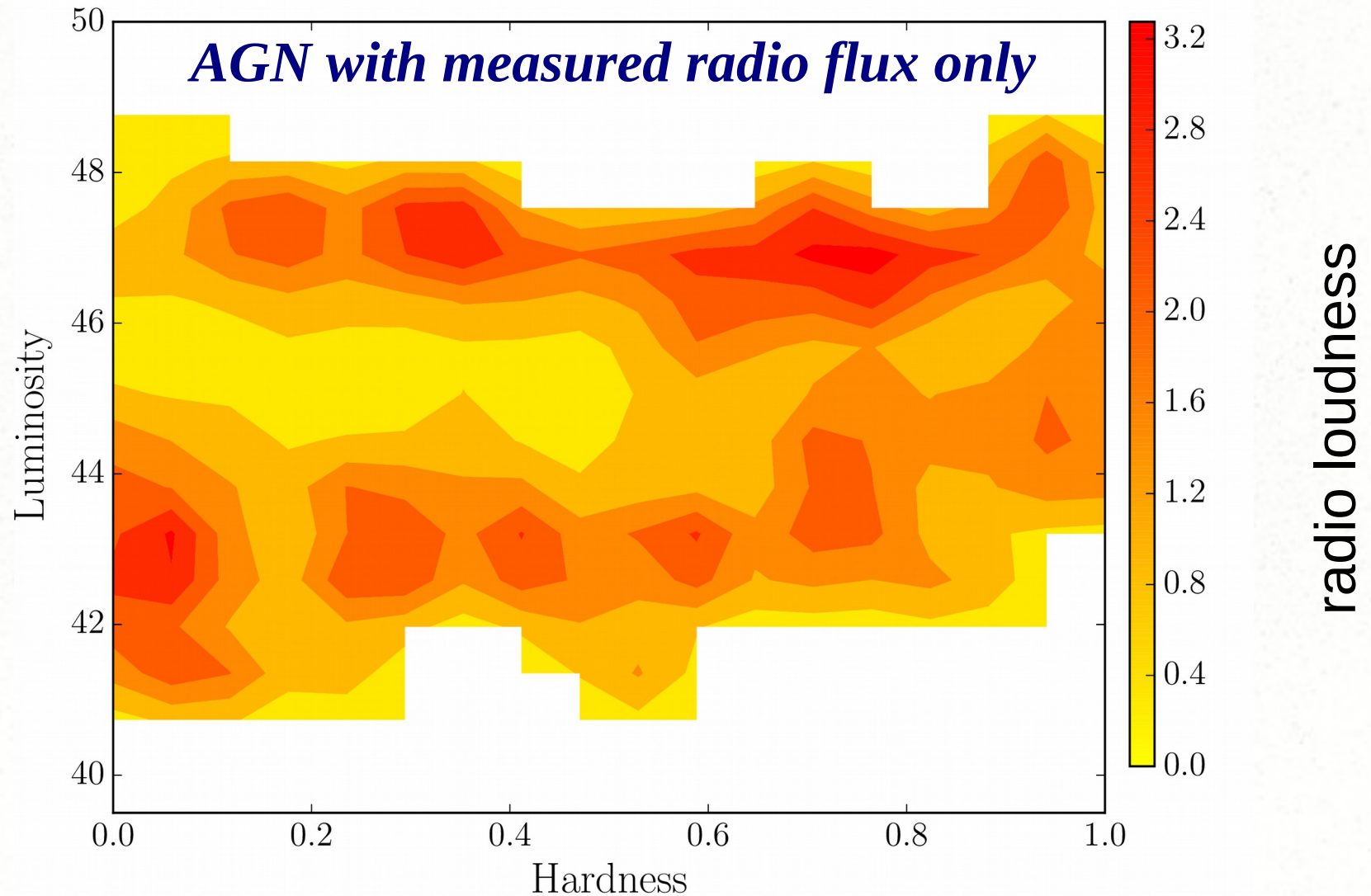
Hardness-Luminosity Diagram



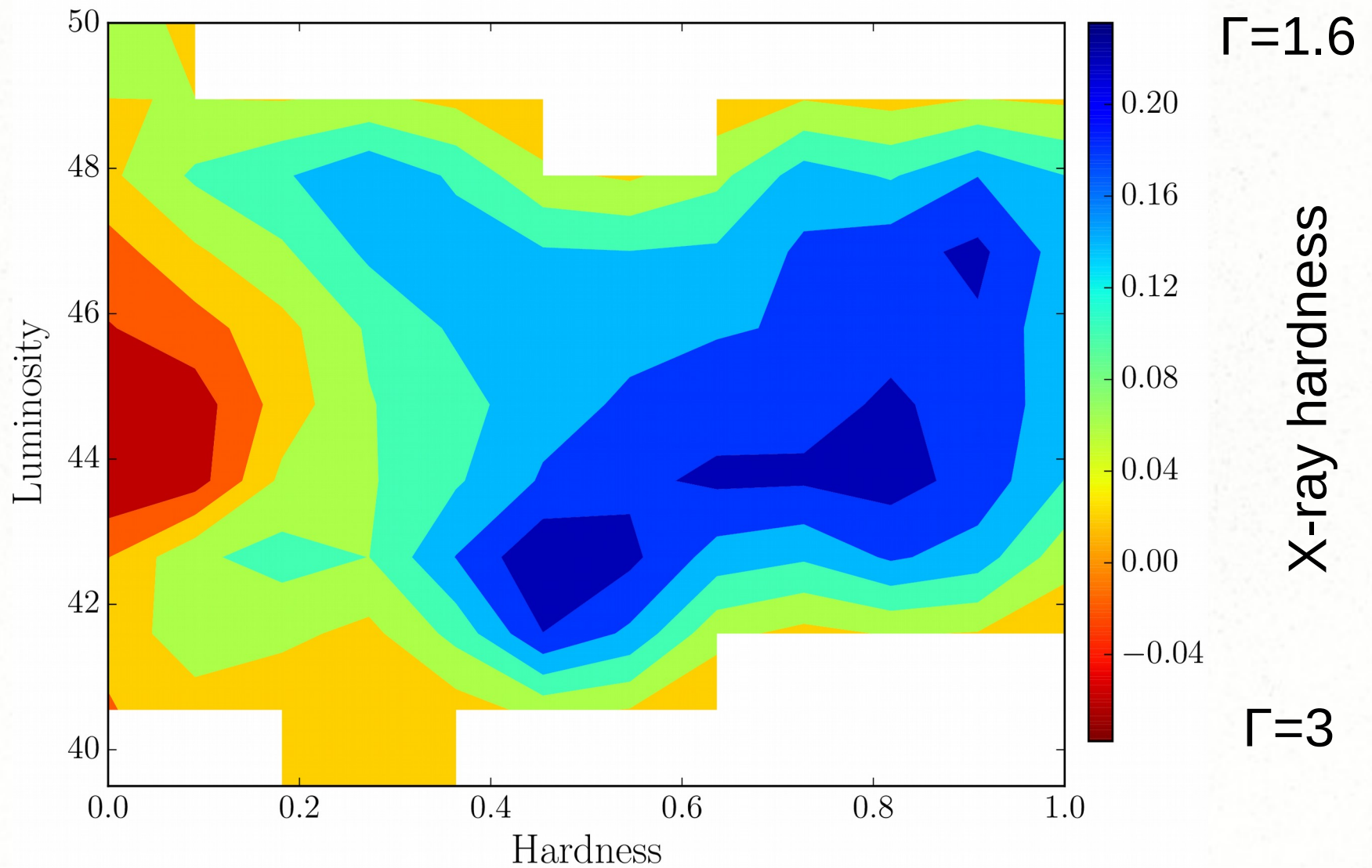
HLD of all galaxies



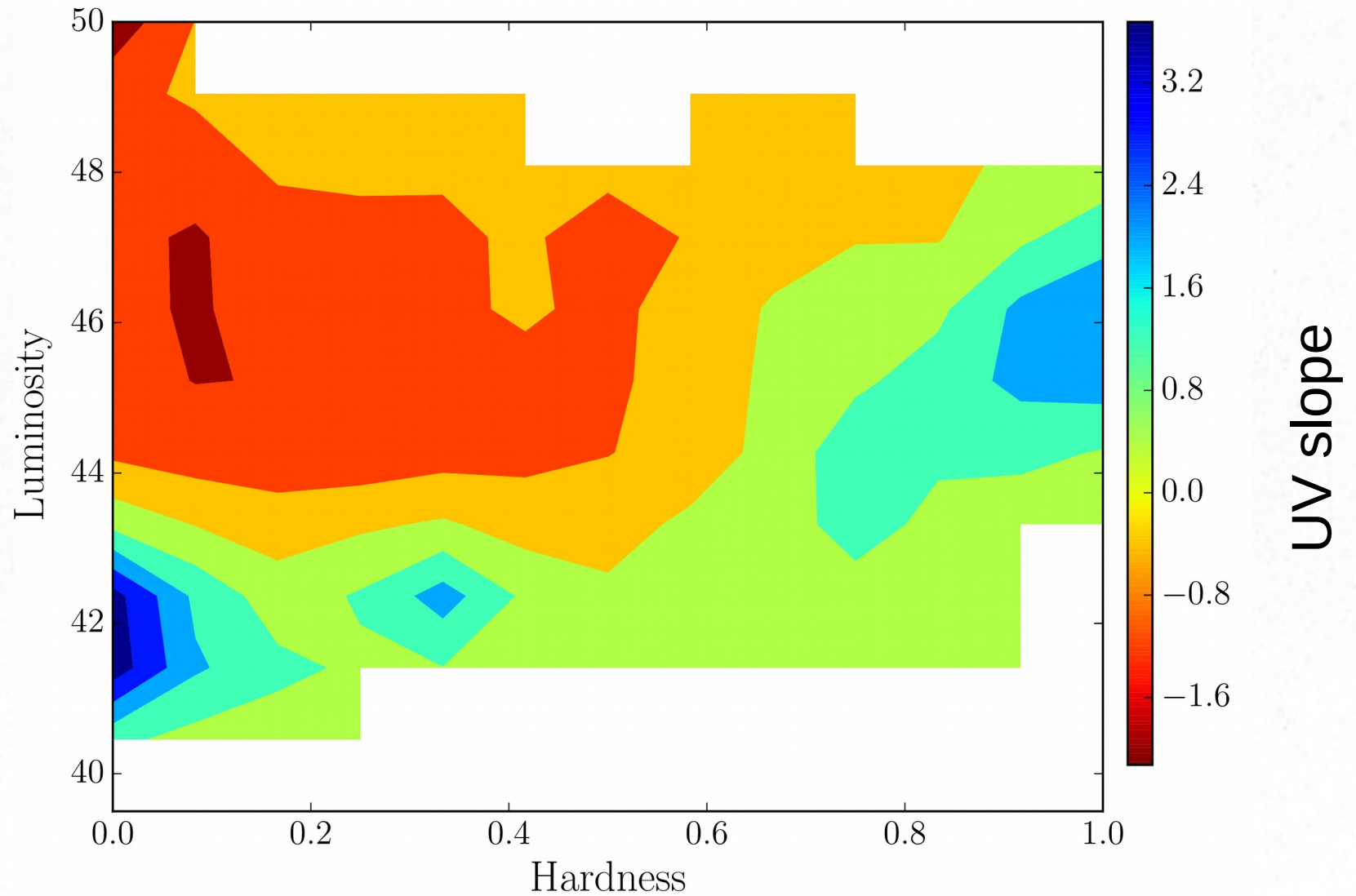
Hardness-Luminosity histogram



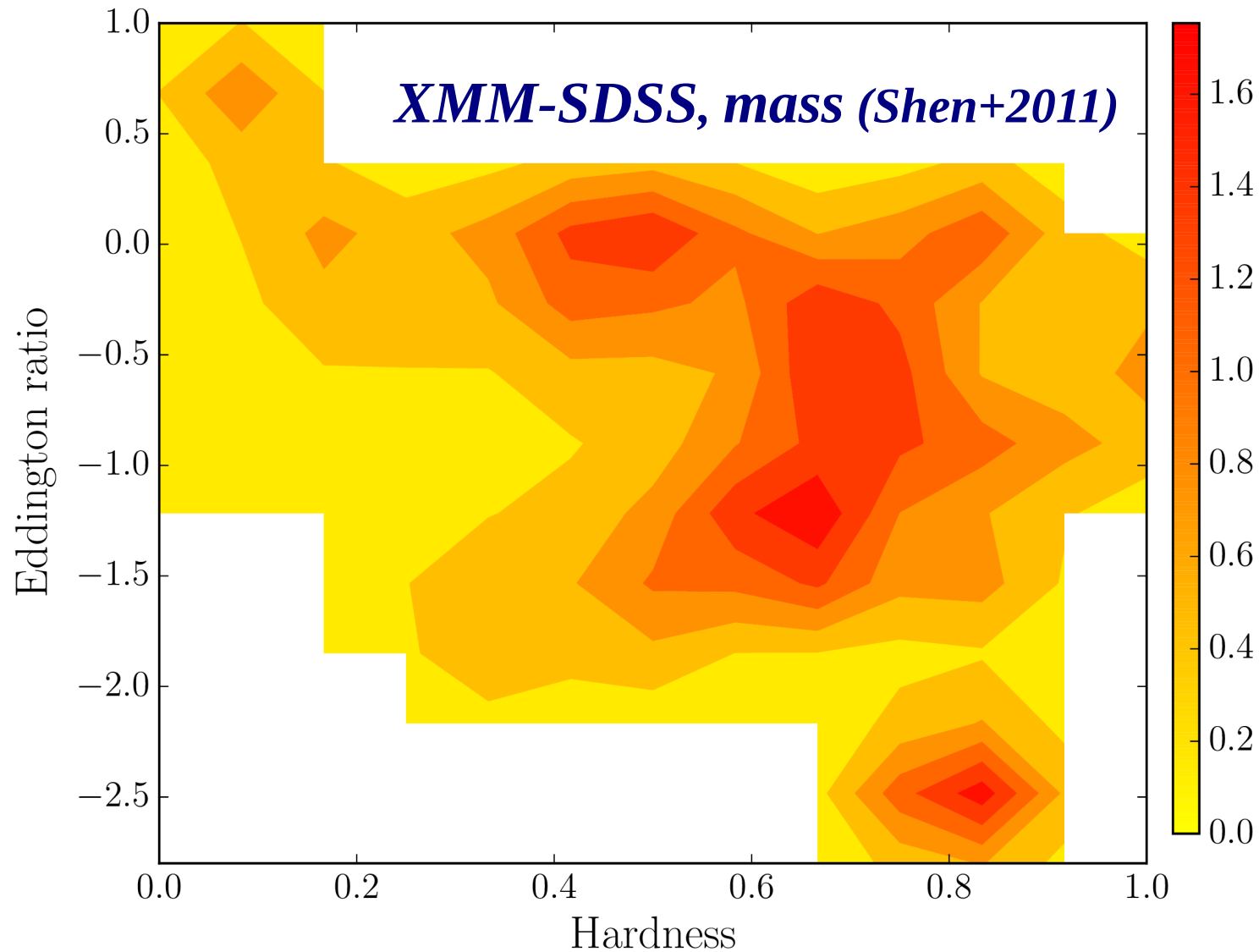
X-ray hardness



UV slope



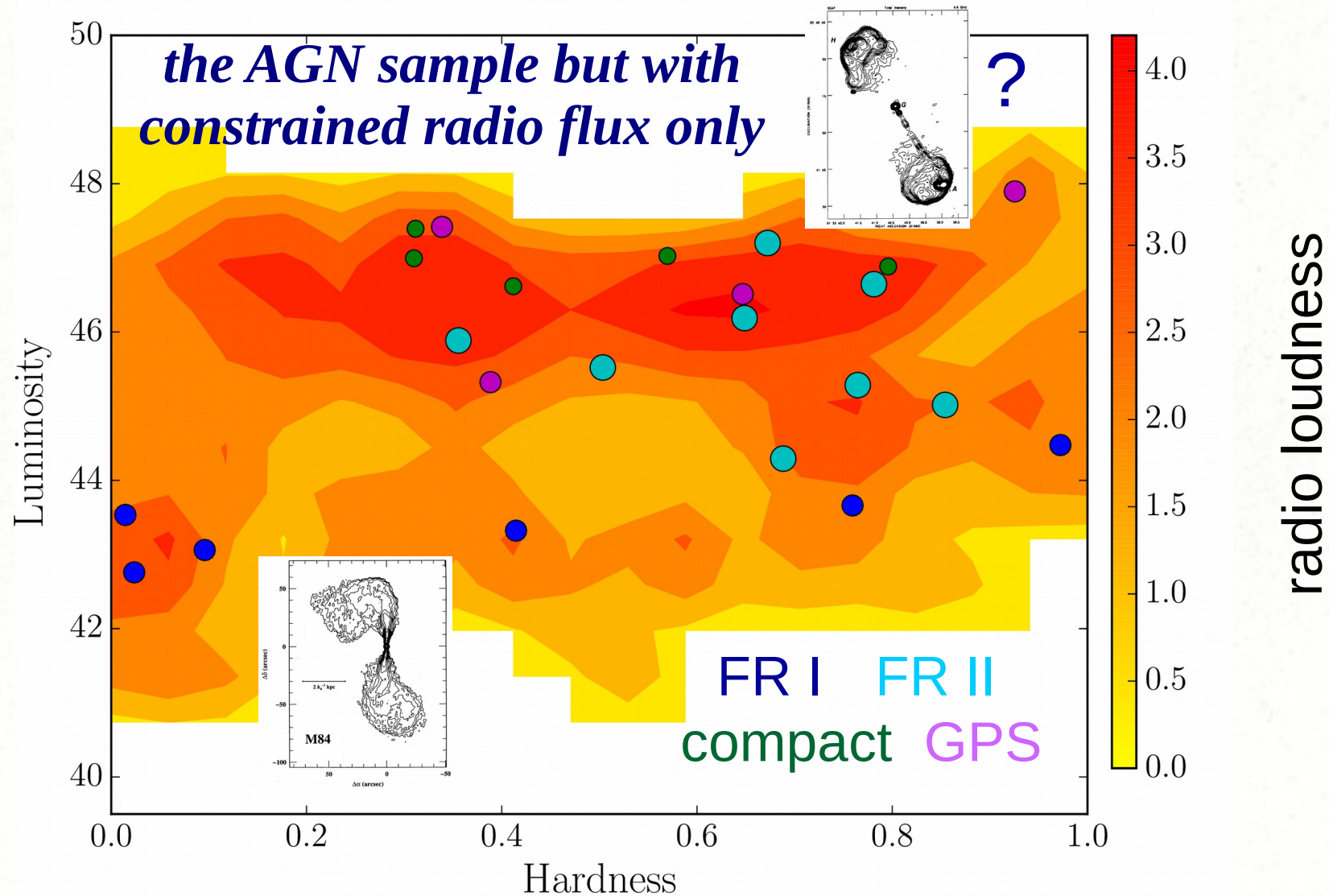
Eddington Ratio instead of Luminosity



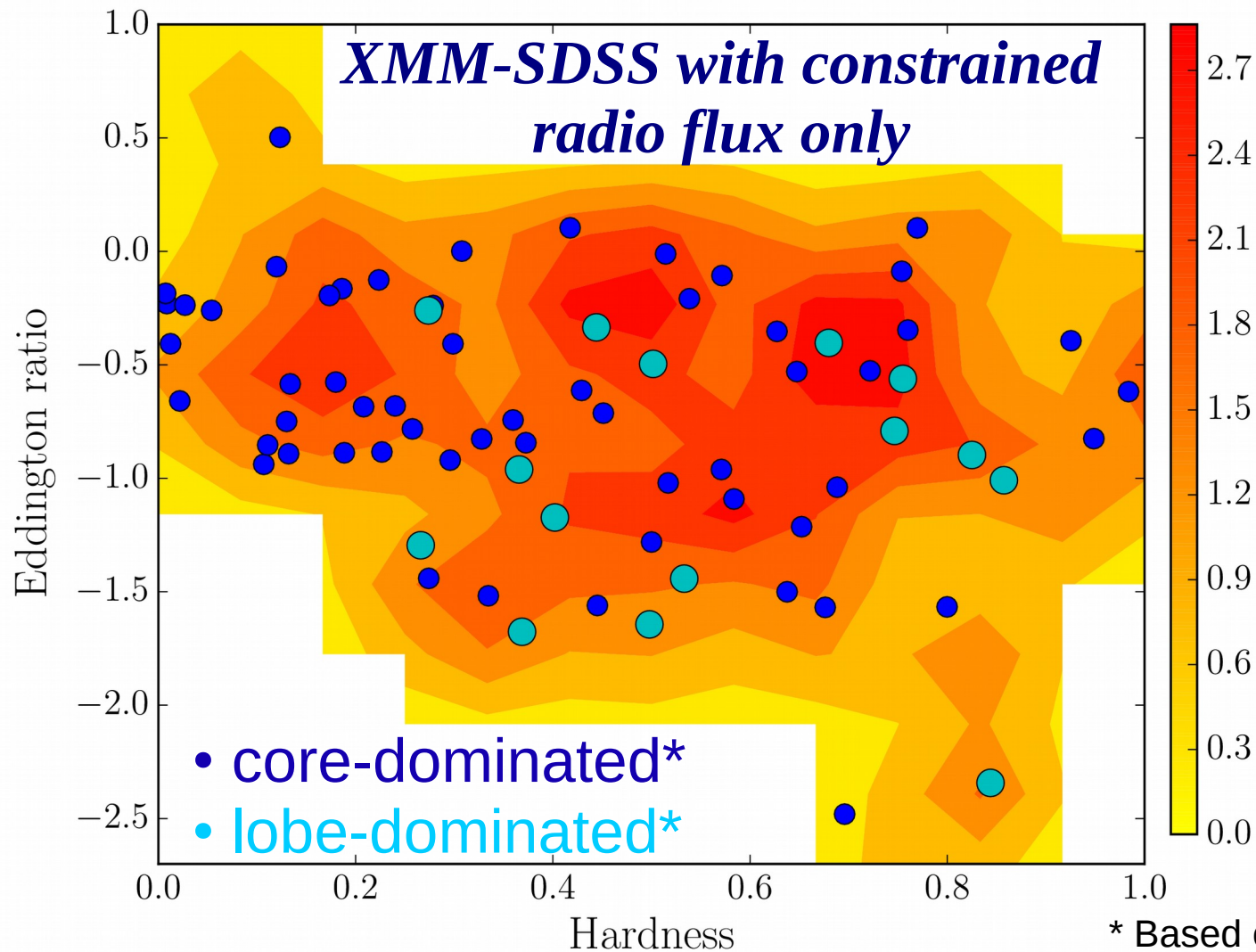
Conclusions

- AGN seem to qualitatively evolve in a similar way as the stellar-mass black hole binaries
- soft and hard states can be distinguished by:
 - **radio loudness**: radio loud in hard states
 - **UV slope**: negative slope (in λ) in soft states
 - **X-ray slope**: steeper X-ray spectra in soft states
- Caveats and open problems:
 - Low-luminosity sources need proper host-galaxy subtraction
 - the Eddington ratio better corresponds to the accretion state than the total (bolometric) luminosity
 - unclear whether the radio morphology is related with the evolution in the AGN state diagram

Radio morphology



Radio morphology in *H-ER* diagrams



Thank you for your attention !!!