

THE X-RAY EMISSION IN WATER MASER AND NON-MASER GALAXIES



K. LEITER^{1,2}, M. KADLER¹, J. WILMS², C. GROSSBERGER^{1,2,3}, F. KRAUSS^{1,2},
A. KREIKENBOHM^{1,2}, M. LANGEJAHN^{1,2}, E. LITZINGER^{1,2}, A. MARKOWITZ^{2,4}, C. MÜLLER^{1,2}

¹ Lehrstuhl für Astronomie, Universität Würzburg, Würzburg, Germany, ² Dr. Karl Remis Sternwarte & ECAP, Universität Erlangen-Nürnberg, Bamberg, Germany,
³ MPE, Garching, Germany, ⁴ University of California, San Diego, USA & von Humboldt Fellow



Abstract

Water maser galaxies are a rare subclass of Active Galactic Nuclei (AGN). They play a key role in modern cosmology, since they provide a significant improvement for measuring geometrical distances with high precision. Therefore, they allow a determination of H_0 with accuracy of better than 3%, providing powerful constraints on the equation of state of dark energy (Braatz 2008, ASPC, 395, 103B). Measurements for every single object are independent, the uncertainty consequently decreases with increasing detections of suitable water masers. We have studied the X-ray properties of a unique and homogeneous sample of Type 2 AGN with water-maser activity observed by *XMM-Newton* to investigate the properties of AGN hosting mega-masers compared to a control sample of non-maser AGN, both analysed in a uniform way. A comparison of the spectral shape of water-maser and non-maser AGN indicates that water-maser X-ray spectra tend to be more complex than non-maser spectra. This suggests that also the physical processes in maser sources are more complex. Here we present a unique, systematically-analyzed sample of maser and non-maser AGN that have been observed by *XMM-Newton*.

Sample Selection

Based on the sample of Zhang et al. (2012), A&A, 538, A152, we compiled a sample of maser (41 AGN) and non-maser (54 AGN) galaxies which have been observed with *XMM-Newton*. The sources were uniformly extracted and analyzed. Fig. 1 shows a comparison of our *XMM*-selected sub-samples and those of Zhang et al. (2012). Below, we present 18 X-ray spectra from each of the maser and non-maser samples, representing the typical distribution of spectral components in each sample.

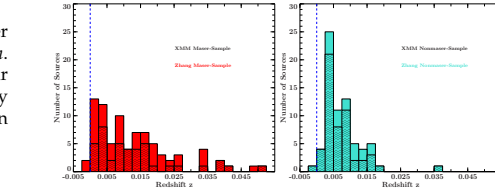
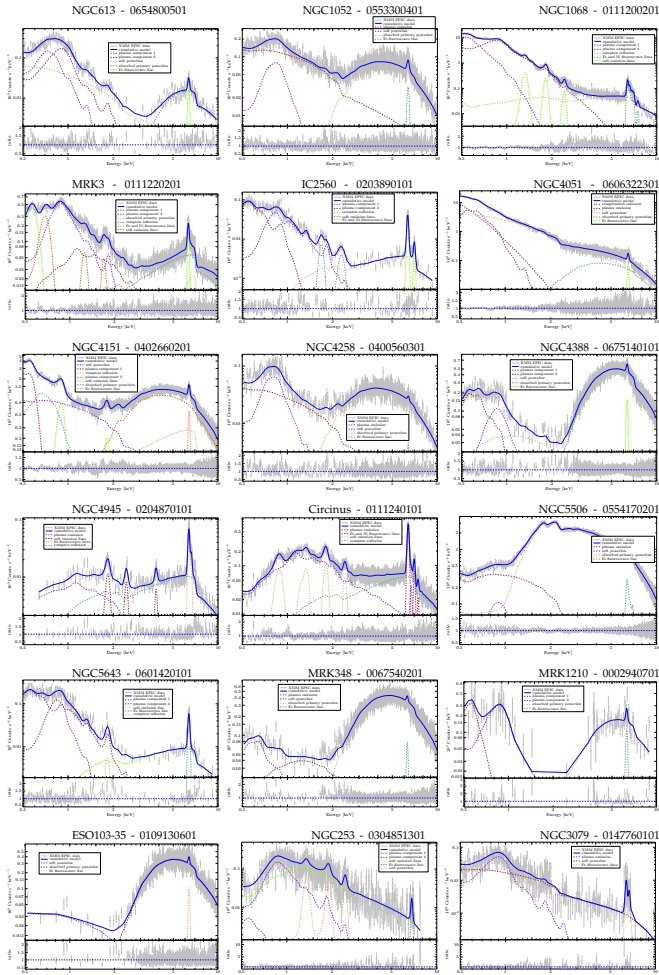


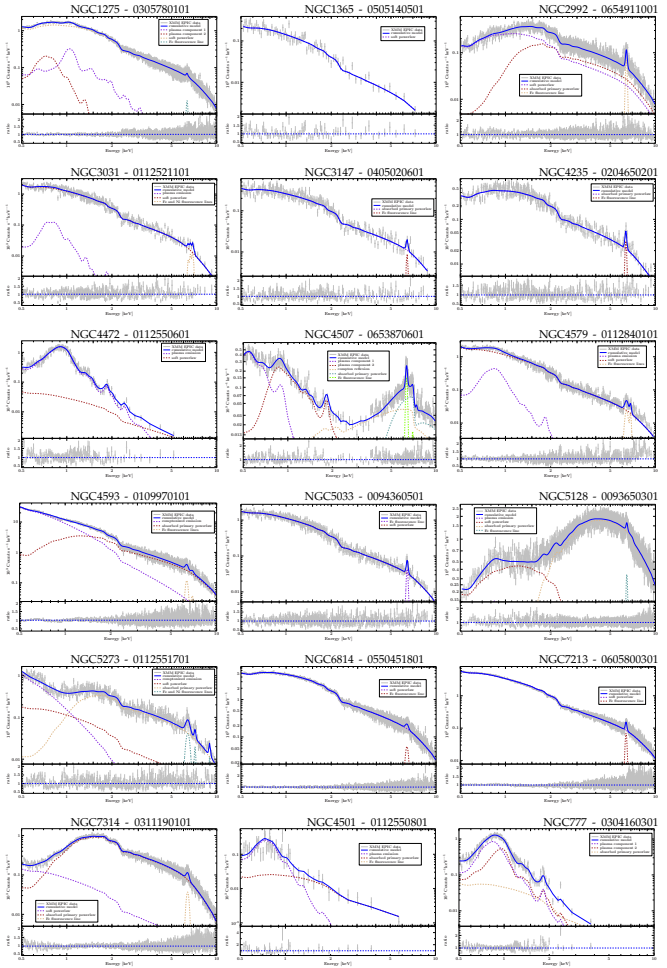
Fig. 1: Comparison of the redshift distribution between Zhang et al. (2012) and the *XMM*-selected maser and non-maser samples.

Comparison of Maser and Non-Maser Spectra (18 representatives out of each sample)

• Maser sources



• Non-Maser sources



Results

- X-ray emission of maser galaxies is generally more complex than in non-maser sources.
 - Maser galaxies exhibit a higher fraction of X-ray reflection than non-maser galaxies. Purely reflection-dominated spectra are only observed among masers.
 - Typical models of maser X-ray spectra include a highly absorbed power law, multiple emission components from ionized plasma as well as X-ray reflection.
 - Non-maser spectra can typically be described by a dominating weakly or partially absorbed powerlaw, ionized plasma emission and emission from neutral iron.
- Previous findings of higher absorbing column densities in maser galaxies (e.g. Castangia et al. 2013, Greenhill et al. 2008) generally confirmed.
- In general, the physical processes in maser sources are more complex than in non-maser sources!

Acknowledgments

This research makes use of data obtained by *XMM-Newton*, an ESA science mission funded by ESA Member States and the USA (NASA). Furthermore this work was partially funded by the Graduiertenkolleg GRK 1147 from the DFG

Contact

kleiter@astro.uni-wuerzburg.de