

An atlas of extragalactic water vapor masers

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Abstract. We present an atlas of extragalactic water vapor masers. As of 2007, one hundred galaxies have been detected as sources of water vapor maser emission, two thirds of them discovered since 2003. Extragalactic water masers fall in at least three categories: those associated with nuclear jets or winds, those in starbursts or star-forming regions, and those in AGN accretion disks. While all maser systems offer the possibility of unique investigations into their physical environments, it is the disk masers that have been most aggressively sought because of their potential for use as precision distance indicators. Type 2 Seyfert and LINER galaxies are hosts to such disk masers. In single-dish spectra, disk masers are often revealed by the presence of high-velocity emission features (defined roughly by having anomalous velocities in excess of 200 km s^{-1}). About one third of the extragalactic water masers detected to date show evidence of disk origin. Only a few galaxies are currently identified as jet-type or star-forming type. The remaining systems show only a few narrow doppler components, usually near the systemic velocity, and are difficult to categorize. These unclassified systems are detected toward AGNs and are also possibly associated with disks or winds near the nucleus. Detection rates in large maser surveys are typically 5% or less, but the observing efficiency and sensitivity of the Green Bank Telescope (GBT) allow for short integration times (typically 10 minutes to detect a narrow 30 mJy line) so many galaxies can be searched. Recently, GBT surveys targeting type 2 Seyfert galaxies identified by the SDSS have been the most productive, identifying 17 systems in surveys observed during 2006.

1. About the maser atlas

The atlas consists of single-dish spectra of 22 GHz water vapor maser emission detected toward the nucleus of each galaxy. Most of the observations were taken with the GBT, and cover at least 200 MHz bandwidth and 24 kHz channel spacing, corresponding to about 2700 km s^{-1} velocity coverage and 0.33 km s^{-1} channels. Typical rms noise levels of GBT spectra are 2–5 mJy per channel. Spectra of southern sources were observed either at Parkes or Tidbinbilla. The on-line atlas will be updated to reflect new discoveries and includes a list of undetected sources as well. The full atlas and catalogs are available at the sites:

<http://www.nrao.edu/~jbraatz>

and

<http://www.cfa.harvard.edu/wmcp>.

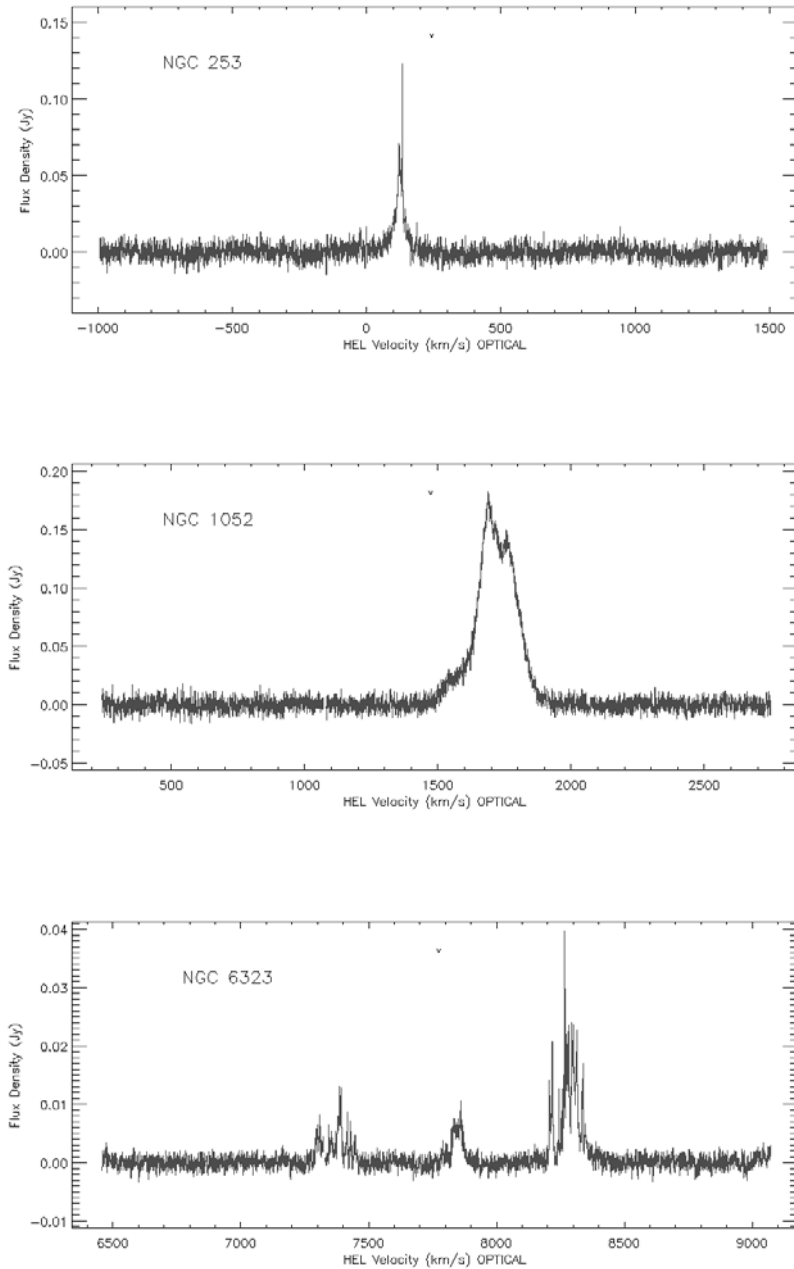


Figure 1. The atlas consists of spectra of nearly 100 extragalactic maser systems. Here we present three representative examples showingGBT spectra of a starburst maser (NGC 253, top), a jet maser (NGC 1052, middle) and a disk maser (NGC 6323, bottom). The complete atlas can be accessed from <http://www.nrao.edu/~jbraatz>.