Academia Sinica Press Release
Astronomers Find Evidence of Galaxies Snacking on Neighbors

Astronomers have long suspected that the extra-bright cores of spiral galaxies, called Seyfert galaxies, are powered by supermassive black holes which consume material, but they could not see how the material started on its journey toward the black hole. Radio-telescope images have revealed previously unseen galactic cannibalism – a triggering event that leads to feeding frenzies by gigantic black holes at the cores of galaxies.

A research team led by Dr. Jeremy Lim of Academia Sinica's Institute of Astronomy and Astrophysics (ASIAA) have found evidence that the Seyfert galaxies are disturbed by ongoing encounters with neighboring galaxies which brings more material within the gravitational reach of the black holes.

Previous research in visible starlight had only shown a small fraction of the Seyfert galaxies were disturbed.

Using images of hydrogen gas in the galaxies generated by the National Science Foundation's Very Large Array (VLA) radio telescope, the research team, found that the Seyfert galaxies are disturbed spatially and usually also kinematically often by tidal interactions with neighboring galaxies.

"The VLA lifted the veil on what's really happening with these galaxies," said Cheng-Yu Kuo, a member of the research team, who is now a graduate student at the University of Virginia. "Looking at the gas in these galaxies clearly showed that they are snacking on their neighbors. This is a dramatic contrast with their appearance in visible starlight," he added.

By comparison, similar VLA images of inactive galaxies showed that very few were disturbed. "This comparison clearly shows a connection between close galactic encounters and the black-hole-powered activity in the cores," said Ya-Wen Tang, who began this work at ASIAA and now is a graduate student at the National Taiwan University (NTU).

"This is the best evidence yet for the fueling of Seyfert galaxies. Other mechanisms have been proposed, but they have shown little if any difference between Seyferts and inactive galaxies," Tang added.

"Our results show that images of the hydrogen gas are a powerful tool for revealing otherwise-invisible gravitational interactions among galaxies," said Jeremy Lim. "This is a welcome advance in our understanding of these objects, made possible by the best and most extensive survey ever made of hydrogen in Seyferts," Lim said.

Dr. Lim and his team, which consists of Cheng-Yu Kuo a graduate student at the University of Virginia; and Dr. Paul Ho and Ya-Wen Tang of the Institute of ASIAA, present their results in two related papers published in the Volume 679 of The Astrophysical Journal on 1 June.

Further information:
Dr. Paul Ho is the Director and Distinguished Research Fellow of the ASIAA.
Dr. Jeremy Lim is an Associate Research Fellow at ASIAA.
Ya-Wen Tang is a Ph.D student at National Taiwan University and doing thesis at ASIAA under Dr. Paul Ho.
Cheng-Yu Kuo is a graduate student at the University of Virginia. He graduated from National Taiwan University Physics Department, and had been research assistant at ASIAA.

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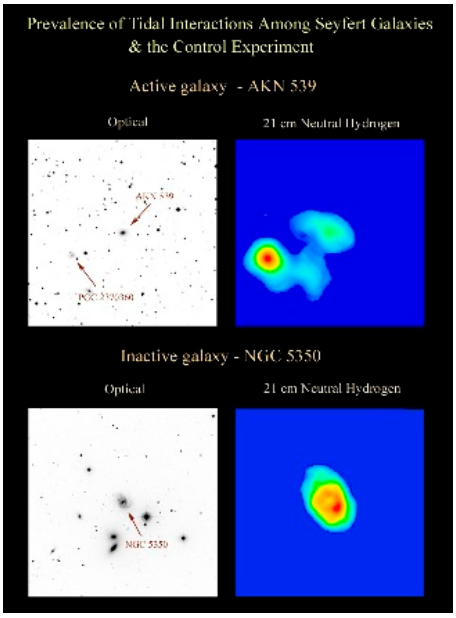
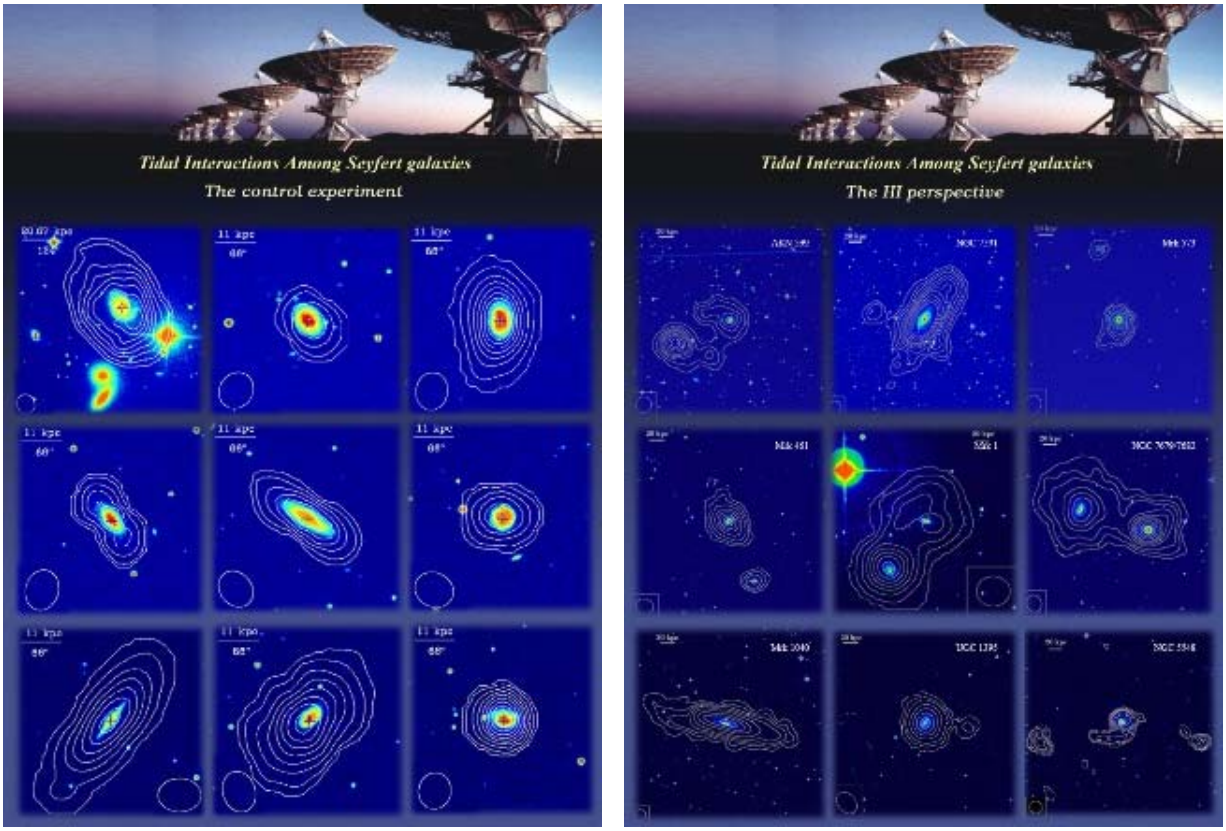


Upper row: Left panel --- Optical picture centered on the Seyfert galaxy AKN 539, showing also its neighboring galaxy PGC 23700360. Apart from its relatively bright nucleus, AKN 539 looks like any other normal galaxy when seen in optical starlight. Right panel --- Atomic hydrogen (HI) gas picture of AKN 539 and PGC 23700360. Unlike their appearances in optical starlight, the two galaxies look strongly disturbed in HI gas. This gas extends far beyond either AKN 539 and PGC 23700360, pulled by the gravitational attraction of each galaxy to form a common bridge linking together both galaxies.
Lower row: Left panel --- Optical picture of the normal galaxy NGC 5350. Right panel --- Atomic hydrogen (HI) gas picture of NGC 5350. Unlike the Seyfert galaxy AKN 539, NGC 5350 looks normal in both optical starlight and HI gas.



Illustrative examples from our atomic hydrogen (HI) gas imaging study of Seyfert galaxies and a control sample of inactive galaxies. HI gas intensity is shown as contours overlaid on false-color optical images of the galaxies studied, located in each case at the center of the individual panels. Although only a small fraction of the Seyfert galaxies are visually disturbed, nearly all are disturbed in atomic hydrogen (HI) gas. In over half the cases, their disturbances can be directly linked through HI tidal bridges or tails to neighboring galaxies detected also in HI gas. In stark contrast, very few of the inactive control sample display either optical or HI disturbances