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New connection between plasma conditions near black hole event horizons and outflow properties

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Accreting black holes are responsible for producing the fastest, most powerful outflows of matter in the Universe. The formation process of powerful jets close to black holes is poorly understood, and the conditions leading to jet formation are currently hotly debated. In this talk I will present recent results that show empirical correlation between the properties of the plasma close to the black hole and the particle acceleration properties within jets launched from the central regions of accreting stellar-mass and supermassive black holes. In these sources the emission of the plasma near the black hole is characterized by a power law at X-ray energies during times when the jets are produced. We find that the photon index of this power law, which gives information on the underlying particle distribution, correlates with the characteristic break frequency in the jet spectrum, which is dependent on magnetohydrodynamical processes in the outflow. The observed range in break frequencies varies by five orders of magnitude, in sources that span nine orders of magnitude in black hole mass, revealing a similarity of jet properties over a large range of black hole masses powering these jets. This correlation demonstrates that the internal properties of the jet rely most critically on the conditions of the plasma close to the black hole, rather than other parameters such as the black hole mass or spin, and will provide a benchmark that should be reproduced by the jet formation models.

Author: KOLJONEN, Karri (New York University Abu Dhabi)

Co-authors: VAN DER HORST, Alexander (George Washington University); RUSSELL, Dave (New York University Abu Dhabi); BERNARDINI, Federico (New York University Abu Dhabi); MILLER-JONES, James (ICRAR/Curtin University); FERNANDEZ-ONTIVEROS, Juan (INAF/IAPS); CURRAN, Peter (ICRAR/Curtin University); CASELLA, Piergiorgio (INAF/Osservatorio Astronomico di Roma); GANDHI, Poshak (University of Southampton); SORIA, Roberto (ICRAR/Curtin University); MARKOFF, Sera (University of Amsterdam); RUSSELL, Thomas (ICRAR/Curtin University)

Presenter: KOLJONEN, Karri (New York University Abu Dhabi)

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