Space jets in a bottle

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By creating space-like conditions in a slim 4m vessel, Italian researchers have helped confirm the behaviour of astrophysical jets – streams of charged particles shot out by supermassive black holes and young stars, which stretch several hundred thousand light years across space.

The streams of initially charged particles – known as astrophysical jets - which can travel close to the speed of light have previously only been understood through computer simulations but are now being brought to life in lab-produced vacuums.

Research published today, Tuesday, 12 April, in New Journal of Physics describes how Italian researchers have created space-like conditions in a vessel in order to use a fast–acting camera to confirm jets' behaviour.

These jets, which originate from the central point of galaxies, are among the largest objects in the universe and are usually associated with disks of tightly packed matter that spiral into objects like stars or black holes, almost like water spiralling into a plug hole.

To create, in part, extraterrestrial conditions in the lab, the researchers from the Politecnico di Torino, Politecnico di Milano, Universita' di Torino and the Max Planck Institute in Goettingen designed a 4m long cylindrical vacuum vessel.

By compressing and pumping gases such as Helium, Argon, Xenon and normal air, the researchers were able to give the gases the energy needed to propel them into the vessel's space-like vacuum.

Towards the end of the 4m vessel, the gases were bombarded with electrons, which excited the atoms and made them visible, therefore allowing them to be captured by a fast-acting camera.

The researchers found that real life astrophysical jets behave in their intermediate and far field in a way which is well represented by Newtonian Dynamics. This behaviour is captured by 3-D computer simulations, confirming how successful 3-D simulations can be for our understanding of inter-galactic behaviour.

Professor Daniela Tordella, of the Department of Aeronautical Engineering, Politecnico di Torino, said: "In modern science, the laboratory experimental proof is the ultimate one. It allows a firm and deep understanding of the phenomenology.

"In the present case, all considered, it is an economic mean of investigation compared to the space telescope observations. Whenever possible, we think that earth laboratory investigations should accompany the observational activity."

More information: iopscience.iop.org/1367-2630/13/4/043011

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