Shear Heating of Black Hole Accretion Disks

Khanna, Ankur

This project is the result of a study into black hole thermodynamics, more specifically accretion thermodynamics. The purpose was to study the environment brought about by the close proximity of two co-rotating black holes with aligned accretion disks, the subsequent shear heating of the black holes' accretion disks, and consequently whether that shear heating would have any effect upon gamma ray polarization in such an environment. A system consisting of two 135 gph water pumps in close proximity to each other inside of a 5.5 gallon tank was set up. The two pumps were conjoined at the bodies to ensure the two stayed together and were set up on a stand built of Legos to ensure that they did not move from their set positions. The system's waster level was set so that the maximum rotation was obtained around the mouth of each of the pumps. Red food coloring was added and talcum powder sprinkled in strategic locations to track water flow. Using video footage from the system, a vector field was generated to indicate the velocity and directional movement of each individual talcum powder particle.Using this vector field, shear calculations were carried out on each of the vectors and a color intensity map of the shear generated. The areas of high shear were found to be directly between the two black holes with this data's application in space, this could lead to a different signature of gamma polarization from nearby black holes with aligned accretion disks.