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The Athena/X-IFU X-ray view of Hot and Energetic Universe: probing the Black Hole environment

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ESA's *Athena* (Advanced Telescope for High-Energy Astrophysics) X-ray observatory mission, to be launched in 2028, will revolutionise our knowledge of the hot and energetic Universe. The X-IFU (X-ray Integral Field Unit) is one of the two instruments on the focal plane of its large X-ray telescope, providing sensitive spatially resolved high-resolution spectroscopy. *Athena*/X-IFU will deliver: (a) 3D mapping of hot cosmic gas through spatially resolved X-ray spectroscopy; (b) Weak spectroscopic line detection and (c) Physical characterization of the hot and energetic Universe through plasma diagnostics, reverberation, line shapes, outflow/inflow spectral features etc. In combination with the other *Athena* instrument, the WFI (Wide Field Imager), the X-IFU will be instrumental in probing the physics around Black Holes in a range of spatial scales. In particular it will measure Super-Massive Black Hole (SMBH) spins through Fe emission line shapes and thence constrain cosmic SMBH growth models; quantify the relationship between accretion and outflows in galactic black holes and other compact sources; measure the mechanical energy of SMBH disk winds and outflows through X-ray absorption features; probe the interaction of these winds and outflows with their surroundings in local galaxies; and quantify the feedback produced by SMBH accretion on galaxy cluster scales by measuring hot gas bulk motions and turbulence.

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