Multi-scale, multi-physics simulation of microquasars - first results

Rolf WALDER[1], Doris FOLINI[1,3], Mickaël MELZANI[1],
Christophe WINISDOERFFER[1] & Jean M. FAVRE[2]
[1.] Centre de Recherche Astrophysique de Lyon, CRAL ENS-Lyon, France
[2.] Swiss Supercompute Center, CSCS Lugano, Switzerland
[3.] Institute for Atmospheric and Climate Science, IACETH, ETH Zürich, Switzerland

Microquasars are complex objects, the description of which demands for a comprehensive approach, comprising a fluid dynamics point of view as well as particle aspects and the decisive role of photons, especially in the vicinity of the accreting black hole. On top of that, as will be highlighted in this presentation, relevant interactions in these objects take place over a multitude of scales. First pure hydrodynamical full-scale simulations of such systems will be presented: from the circum-binary scale down to the scale of the gravitational radius of the black hole. For wind-accreting high mass systems like Cyg X-1, it is discussed under what conditions, on what scale, and how what kind of accreting structure is formed and what their characteristics are. It will be shown that the answer to these questions strongly depends on the wind speed, but also on the interplay of different scales of the accretion flow. In particular, scales in the vicinity of the black hole are important for the stability of the global accretion flow within the Bondi-Hoyle scale. It is further discussed on what scales the flow is unlikely to reach thermodynamical equilibrium and touch on the related issue of particle acceleration.