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Issues in Space Physics in Need of Reconnection with Laboratory Physics[1] B. COPPI, MIT — Predicted space observations, such as the "foot" in front of collisionless shocks or the occurrence of magnetic reconnection in the Earths magnetotail leading to auroral substorms, have highlighted the fruitful connection of laboratory and space plasma physics. The emergence of high energy astrophysics has then benefitted by the contribution of experiments devised for fusion research to the understanding of issues such as that of angular momentum transport processes that have a key role in allowing accretion of matter on a central object (e.g. black hole). The theory proposed for the occurrence of spontaneous rotation in toroidal plasmas was suggested by that developed for accretion. The particle density values, $\simeq 10^{15}$ cm^{-3} that are estimated to be those of plasmas surrounding known galactic black holes have in fact been produced by the Alcator and other machines. Collective modes excited in the presence of high energy particle populations in laboratory plasmas (e.g. when the "slide away" regime has been produced) have found successful applications in space. Magnetic reconnection theory developments and the mode particle resonances associated with them have led to envision new processes for novel high energy particle acceleration.

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B. Coppi
MIT

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