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General relativistic viscous accretion disc and generation of bipolar jets

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We revisit the general relativistic viscous accretion disc. As in Newtonian fluid, the viscous tensor is proportional to the shear tensor in relativistic fluid too, and the constant of proportionality is the constant of viscosity. However, in relativity the shear tensor is much more complicated, containing four accelerations, gradient of three velocities, expansion of world line terms etc. This inherent complication makes a consistant study of viscous accretion discs around black holes very difficult. In this presentation, we solve the equations of general relativistic viscous disc in steady state. We show that such accreting flows may admit shock waves. The extra heating term in the post-shock disc may spew out bipolar jets. In order to determine the jet streamline and jet cross section we obtained the corresponding von Zeipel cylinders. We then trace the matter that will escape through these surfaces. We also show that 4 to 5 % of accreting matter escapes as bipolar relativistic jets. Comparison with Newtonian plus pseudo-Newtonian and the pure general relativistic studies shows that the jets are much stronger in the latter case. And finally we discuss the observational implications.

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