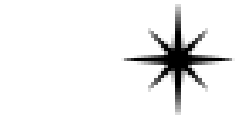

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Determination of chaotic behaviour in time series generated by charged particle motion around magnetized Schwarzschild black holes

Tuesday 6 September 2022 16:30 (20 minutes)

We study behaviour of ionized region of a Keplerian disk orbiting a Schwarzschild black hole immersed in an asymptotically uniform magnetic field. In dependence on the magnetic parameter B, and inclination angle θ of the disk plane with respect to the magnetic field direction, the charged particles of the ionized disk can enter three regimes: a) regular oscillatory motion, b) destruction due to capture by the magnetized black hole, c) chaotic regime of the motion. In order to study transition between the regular and chaotic type of the charged particle motion, we generate time series of the solution of equations of motion under various conditions, and study them by non-linear (box counting, correlation dimension, Lyapunov exponent, recurrence analysis, machine learning) methods of chaos determination. We demonstrate that the machine learning method appears to be the most efficient in determining the chaotic region of the θ–r space. We show that the chaotic character of the ionized particle motion increases with the inclination angle. For the inclination angles $\theta \sim 0$ whole the ionized internal part of the Keplerian disk is captured by the black hole.

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