

We study the dynamics of time-like geodesics in the field of black holes perturbed by a circular ring or disc, restricting to static and axisymmetric class of space-times. Two analytical methods are tested which do not require solving the equations of motion: (i) the so-called geometric criterion of chaos based on eigenvalues of the Riemann tensor, and (ii) the method of Melnikov which detects the chaotic layer arising by break-up of a homoclinic orbit. Predictions of both methods are compared with numerical results in order to learn how accurate and reliable they are.