

Motivated by modelling of astrophysical black holes surrounded by accretion structures, as well as by theoretical interest, we study two methods how to obtain, within stationary and axisymmetric solutions of general relativity, a metric describing the black hole encircled by a thin ring or a disc. The first is a suitable perturbation of a Schwarzschild black hole. Starting from the seminal paper by Will (1974), we showed that it is possible to express the Green functions of the problem in a closed form, which can then be employed to obtain, e.g., a reasonable linear perturbation for a black hole surrounded by a thin finite disc. In the second part we tackle the same problem using the Belinskii–Zakharov generating algorithm, showing/confirming that in a stationary case its outcome is unphysical, yet at least obtaining a modest new result for the (static) “superposition” of a Schwarzschild black hole with the Bach–Weyl ring.