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Predicting the direction of the final spin from the coalescence of two black holes ENRICO BARAUSSE, University of Maryland, LUCIANO REZZOLLA, Albert-Einstein-Institut, Golm, Germany — Knowledge of the spin of the black hole resulting from the merger of a generic black-hole binary is of great importance for studying the cosmological evolution of supermassive black holes. Several attempts have been made to model the spin via simple expressions exploiting the results of numerical-relativity simulations. While these expressions are in reasonable agreement with the simulations, they neglect the precession of the binary's orbital plane, and cannot therefore be applied directly – *i.e.,* without evolving the system to small separations using post-Newtonian theory – to binaries with separations larger than a few hundred gravitational radii. While not a problem in principle, this may be impractical if the formulas are employed in cosmological merger-trees or N-body simulations, which provide the spins and angular momentum of the two black holes when their separation is of hundreds or thousands of gravitational radii. The formula that we propose is instead built on improved assumptions and gives, for any separation, a very accurate prediction both for the norm of the final spin and for its direction. By comparing with the numerical data, we also show that the final-spin direction is very accurately aligned with the binary's total angular momentum at large separation.

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