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Influence of Relativistic Effects on the Evolution of Triple Black Hole Systems

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The evolution of triple black hole systems was studied using the number of binary interactions occurring during the lifetimes of such systems as one of the parameters. The initial conditions that were varied to change the influence of relativistic effects were the masses of the black holes. Mathematical modelling was implemented with the use of computer simulations on FORTRAN. The code for numerical integration of the equations of motion with post-Newtonian corrections up to 7th order, written by Prof. Seppo Mikkola, was used for the integration of orbits of triple black holes [1],[2]. Black holes, with zero initial velocity, were placed at the vertices of Pythagorean triangles. This was done as a continuation of the study conducted in [3] where the (3,4,5) triangle was analysed as started by the classic Burrau paper [4]. Sixteen Pythagorean configurations were used, all with c<100. For each of the sixteen triangles, masses of the black holes were varied from 10 to 10^{12} Solar masses, forming 12 cases per one triangular configuration. The lifetime of the system and the number of binary encounters in each of the individual cases were found. Orbital plots were also made for comparative purposes. Results indicate that supermassive cases demonstrate shorter lifetimes with orderly behavior and fast mergers while the less massive cases typically are longer lasting and demonstrate more binary interactions and more complicated orbits.

Keywords
Three body problem, Relativistic effects, Black holes

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