Gravitational radiation from approaching neutron stars and the problem of gravitational signal from the SN 1987A

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We consider the evolution of a double neutron star binary under the effect of two factors: gravitational radiation and mass transfer between the components. The gravitational radiation is specified under the justified assumption of a circular orbit and point masses and in the approximation of a week gravitational field at nonrelativistic velocities of the binary components. During the first evolutionary phase, determined only by the gravitational radiation, the neutron stars approach each other according to a simple analytic solution. The second evolutionary phase begins at the time of Roche-lobe filling by the low-mass component, when the second factor, the mass transfer as a result of the mass loss by the latter, also begins to affect the evolution. Under the simplest assumptions of conservative mass transfer and exact equality between the Roche-lobe radius and the radius of the low-mass neutron star, it is still possible to extend the analytic solution of the problem of evolution at its second phase. We present this complete solution at both phases and, in particular, give theoretical light curves for the gravitational radiation that depend only on two parameters (total mass of the binary system and initial mass ratio). Based on our solution, we analyze the theoretical gravitational signals from the SN 1987A. The analysis includes the hypothesis about the rotational explosion mechanism for collapsing supernovae.