Implications of the Discovery of Millisecond Pulsar in SN 1987A

長滝重博[1]

Abstract

Since there were few informations on the pulsar in the remnant of SN 1987A, its properties such as its angular velocity of rotation, strength of the magnetic fields, and total baryon mass were treated as free parameters or output parameters. However, Middleditch et al. (2000) reported the discovery of an optical pulsar whose frequency is 467.5 Hz and spindown rate is (2-3)$\times 10^{-10}$ Hz s^{-1} (astro-ph/0010044). Since some free parameters in the previous papers are constrained by this discovery, we consider its implications in this study. From the observation of the millisecond pulsar in SN 1987A, the following implications are obtained. 1) The pulsar spindown in SN 1987A is caused by radiating gravitational waves rather than by magnetic dipole radiation and/or relativistic pulsar winds. 2) A mildly deformed shock wave would be formed at the core-collapse and explosion in SN 1987A, which is consistent with the conclusion derived in Nagataki (2000). 3) The gravitational waves from the pulsar will be detected in (5-20) years by the Fabry-Perot-Michelson interferometer as the gravitational detector such as LIGO and TAMA. 4) The neutrino oscillation model is not a promising one for the explanation of the kick velocity of the pulsar in SN 1987A. The hydrodynamical instability model will be more favored.

Subject headings: supernovae: general — supernovae: individual (SN 1987A) — nucleosynthesis — matter mixing — neutron star: general — pulsar kick

References

1. S. Nagataki, K. Sato 2000 *Prog. Theor. Phys.*, submitted.

2. S. Nagataki 2000, *Astrophys. J. Suppl.* **127** 141

[1] Department of Physics, School of Science, the University of Tokyo
E-mail: nagataki@utap.phys.s.u-tokyo.ac.jp