X32a AGN Feedback Model in GADGET3-Osaka: Isolated Galaxy

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It has been known that supermassive black holes (SMBH) in galactic nuclei co-evolve with their host galaxy. However, how they interact is still not well understood and many researches have been done to simulate the impact of active galactic nuclei (AGN) feedback to the galaxy and how it affects the SMBH growth. In this research, we use our GADGET3-Osaka code to model the AGN feedback and SMBH evolution. In our model, we introduce two mode of AGN feedback: quasar and radio mode. We change the mode of feedback according to the accretion rate of the SMBH. Quasar mode is used when accretion rate is high, while radio mode is when accretion rate is low. In quasar mode, we introduce geodesic dome bins in which the energy is assigned equally. The more gas inside a bin, the less energy each gas particles will receive. In this process, we can expect that the energy will be transferred more efficiently through low density region. In radio mode, we introduce jet feedback to distribute the energy, where we use ghost particles to carry and distribute energy to certain direction determined based on angular momentum direction of gas around the SMBH. This new scheme of AGN feedback will affect the evolution of galaxies by self-regulating the gas in the system. We can expect the quenching of star formation rate and accretion rate of SMBH to slow down as the AGN feedback will heat up the circumgalactic medium thus reducing gas inflow into the galaxy disk.