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Quasi-Periodic Pulsations in the Gamma-Ray Emission of a Solar Flare

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Quasi-periodic pulsations (QPPs) of gamma-ray emission with a period of about 40 s are found in a single loop X-class solar flare on 2005 January 1 at photon energies up to 2-6 MeV with the SOlar Neutrons and Gamma-rays (SONG) experiment aboard the CORONAS-F mission. The oscillations are also found to be present in the microwave emission detected with the Nobeyama Radioheliograph, and in the hard X-ray and low energy gamma-ray channels of RHESSI. Periodogram and correlation analysis shows that the 40 s QPPs of microwave, hard X-ray, and gamma-ray emission are almost synchronous in all observation bands. Analysis of the spatial structure of hard X-ray and low energy (80-225 keV) gamma-ray QPP with RHESSI reveals synchronous while asymmetric QPP at both footpoints of the flaring loop. The difference between the averaged hard X-ray fluxes coming from the two footpoint sources is found to oscillate with a period of about 13 s for five cycles in the highest emission stage of the flare. The proposed mechanism generating the 40 s QPP is a triggering of magnetic reconnection by a kink oscillation in a nearby loop. The 13 s periodicity could be produced by the second harmonics of the sausage mode of the flaring loop.